

**DEPARTMENTS OF VETERANS AFFAIRS AND  
HOUSING AND URBAN DEVELOPMENT, AND  
INDEPENDENT AGENCIES APPROPRIATIONS  
FOR FISCAL YEAR 2004**

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**THURSDAY, APRIL 3, 2003**

U.S. SENATE,  
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,  
*Washington, DC.*

The subcommittee met at 10 a.m., in room SD-138, Dirksen Senate Office Building, Hon. Christopher S. Bond (chairman) presiding.

Present: Senators Bond and Mikulski.

EXECUTIVE OFFICE OF THE PRESIDENT

OFFICE OF SCIENCE AND TECHNOLOGY POLICY

STATEMENT OF JOHN H. MARBURGER, III, DIRECTOR

NATIONAL SCIENCE FOUNDATION

STATEMENT OF RITA R. COLWELL, DIRECTOR

ACCOMPANIED BY:

WARREN M. WASHINGTON, CHAIR, NATIONAL SCIENCE BOARD

CHRISTINE C. BOESZ, INSPECTOR GENERAL

MARY CLUTTER, ASSISTANT DIRECTOR FOR BIOLOGICAL  
SCIENCES

OPENING STATEMENT OF SENATOR CHRISTOPHER S. BOND

Senator BOND. Welcome. The Subcommittee on Veterans, Housing, and Independent Agencies will come to order. This hearing will be on the budget for fiscal year 2004 for the National Science Foundation, the National Science Board, and the Office of Science and Technology. We are pleased to welcome back Dr. John Marburger from OSTP, Dr. Rita Colwell from NSF, Dr. Warren Washington from the National Science Board, and we also welcome back Dr. Tina Boesz, Inspector General of the NSF, who has done an outstanding job of providing independent and objective information on the Foundation's management practices.

Because of very busy schedules today I have asked my distinguished colleague, Senator Mikulski, to give her opening statement first because I know she has many commitments, and we will try to do our best carrying on without her.

## STATEMENT OF SENATOR BARBARA A. MIKULSKI

Senator MIKULSKI. Well, thank you very much, Mr. Chairman, and I want to thank you for your courtesy and, of course, to welcome Drs. Colwell, Marburger, Washington, and Boesz. I once again want to reiterate how glad I am that we are partners on the National Science Foundation appropriations, and in our continued national goal of doubling NSF's budget; we are now in our second year of our 5-year commitment.

It looks like it is going to be a bit difficult to meet the doubling commitment, but the commitment is still there because not only do we think that science is bipartisan, but that science should be non-partisan, and that we need to work together to fund the next generation of scientists and the next generation of ideas.

When I look at the NSF budget for 2004, I note that it is just 3 percent over last year, and I am troubled that the research budget, the very core of NSF, is increased only by 1.2 percent. This number does not even account for inflation.

We were disappointed last year with the NSF budget, and we still are. We are wholeheartedly and enthusiastically behind the increase in the National Institutes of Health, but it is not that we should fund one and not the other. I believe this is not an NSF budget. I believe it is an OMB budget.

In the omnibus, Senator Bond and I gave NSF a 10 percent increase over last year. Every major report on long-term U.S. economic competitiveness has cited the need for major increases in scientific research. This is where the ideas and the jobs will come for tomorrow.

The paltry 1.2 percent increase in research stands in marked contrast, however, to the increase for major equipment. I think we should keep an eye on the major equipment. We do need the hardware and telescopes and we are very pleased at the modernization at the South Pole, which had not been done in a number of years, but we need to really be looking at research.

The education budget fares only slightly better. It is increased by 4 percent, primarily in the President's Math and Science Partnership. We want to support the President, but we need to look at a more balanced approach.

I am enthusiastic, though, about the increase of graduate stipends to \$30,000. Last year, we increased it from \$18,500 to \$25,000, and I said to Senator Bond, this could turn out to be one of the most important things we do this year, and I am so pleased that you told us that applications have gone from 5,000 to 8,000, and thanks to my Senator's calculations that is a 60 percent increase.

I believe that the President, his team, and you are very wise to say, let us increase it to \$30,000, because I truly believe for many of our students their student loans are their first mortgage, and they cannot continue to layer on debt, particularly if they are looking for jobs in academia or in the nonprofit world.

So we really look forward to this. However, we do hope that we can find a way to fund TechTalent, which goes to undergraduate education, which being an Oriole fan, I know how important a farm team is. It really starts K through 12, even really starts in Head

Start, but all the way through, to make sure that our undergraduates are working on this.

We want to continue to work on workforce readiness, focus particularly on women and minorities, and we cannot forget our community colleges. Perhaps it does not prepare people for Ph.D.s, but it prepares them for the science world we need, the community college graduate in nursing, radiology technology. Allied healths alone, as well as some of the other basic fields, would be very important.

And again, we want to thank Dr. Marburger, an advisor to the President, and we look forward to working with him. Our homeland security does continue to be a top priority with both of us, and we look forward to hearing you.

Mr. Chairman, thank you. Those are my remarks, and just because I might have to leave does not mean that you do not have my wholehearted support in an idea on how we can continue our doubling efforts in strategic areas.

#### PREPARED STATEMENT

Senator BOND. Senator Johnson has submitted a statement that he wishes to be included for the record.

[The statement follows:]

#### PREPARED STATEMENT OF SENATOR TIM JOHNSON

Thank you Chairman Bond and Senator Mikulski for holding this important hearing today. I look forward to the testimony of our distinguished witnesses this morning to discuss the exciting opportunities in science and technology.

I strongly support efforts to enhance core sciences through investments in capacity, education, and basic research. Efforts to double the resources allocated to the National Science Foundation are essential to reinforce our understanding in multiple scientific disciplines. I applaud Senators Bond and Mikulski for their leadership on behalf of NSF and our scientific community.

The work of the National Science Foundation is instrumental to support basic research. The discoveries we make in core sciences lay the groundwork for applications and breakthroughs that impact telecommunications, health care, environmental sciences, biotechnology, and numerous aspects of our lives. Many of these developments evolve into commercial adaptations and other products which contribute to our national security, economic growth and enhance our quality of life.

I strongly support the important work accomplished by the EPSCoR program to help small States develop R&D infrastructure at colleges and universities. NSF's EPSCoR program has been instrumental in expanding scientific opportunities and building the capacity necessary to sustain research and development initiatives around the country. While the fiscal year 2004 budget proposal for EPSCoR is disappointingly low, I hope that we may work together to reinforce our commitment to develop scientific opportunities in all sectors of higher education.

There remains a great deal of interest within the scientific community with regard to establishing a National Underground Science and Engineering Laboratory. The National Academies of Science have reviewed the potential merits of such an initiative and have reported favorable findings. As the National Science Foundation continues to prioritize the needs and opportunities for fundamental scientific exploration, we appreciate the consideration provided to the views of scientists and researchers regarding this proposed initiative.

I congratulate NSF for undertaking exciting endeavors to better understand the composition, evolution, and interactive systems of our planet. The EarthScope initiative is employing new observational technologies to investigate the structure and dynamic processes of the North American continent. Among the many potential benefits of this program, the research may provide greater understanding of the evolution of the Rocky Mountains and the Northern Great Plains.

The NEON concept is another promising effort being initiated at NSF to establish national sites for the "National Ecological Monitoring Network." We look forward to the contributions of this important research.

I applaud the National Science Foundation, the National Science Board, and the Office of Science and Technology Policy for their commitment and dedication to our Nation's science programs.

Senator BOND. Well, thank you very much, Senator Mikulski, and before Senator Mikulski leaves I am going to take the chairman's prerogative to tell you a little parochial story.

This past Friday, talking about getting young people interested, I went to the St. Louis Science Center, which I believe is partially funded through the informal science education program. I was announcing three-quarters of a million dollars to help them develop a program to explain biotechnology to the kids, but the greatest thing, it was a rainy day and the place was jam-packed. They expected 10,000 kids, and there were kids from kindergarten up through all the grades. They were coming into this wonderful area to get them enthused and interested and curious about science.

And we are talking about the farm team. This is beginning to work at the little leagues, because if we can get them interested in and enthusiastic about science, we have got an opportunity to make mathematicians and scientists out of them. That is when I got really interested in it, and I was on that path until I ran into the theory of calculus, and that is when I decided to go into social sciences.

Senator MIKULSKI. Senator, for me it was organic chemistry and Boyle's gas laws, and there I learned that gas takes the size and shape of its container. That is interesting to know when you join the Senate.

Senator BOND. Senator, I do not believe we will follow that one any further. I believe we have gone far enough down that line. Now back to work.

But I agree with you it is truly exciting to see young people who are getting interested in science, and we have got to have lots more of them. Senator Mikulski and I have long joined you as leaders in our science effort to say that the tremendous challenge that our Nation faces is our failure to educate enough mathematicians, scientists, and engineers to deal with the tremendous developments that are coming forward in the future, so that is a very strong personal interest that we have.

But this hearing is a very important one today, because it gives us the opportunity to talk about the critical role the National Science Foundation plays in the economic and intellectual growth and the well-being of the Nation. Most policy experts believe that investment in the physical sciences and engineering not only benefits the high tech industries but all major research areas, including biomedical research.

In the words of Dr. Harold Varmus, the former Director of the National Institutes of Health, scientists can wage effective war on disease only if we as a Nation and as a scientific community harness the energies of many disciplines, not just biology and medicine, close quotes, or in my words, supporting NSF supports NIH.

Unfortunately, while Federal support in life sciences has increased significantly, the combined share of the funding for physical science and engineering has not kept pace. I am alarmed and troubled by this disparity, because a decline in funding for the physical sciences has put our Nation's capabilities for scientific in-

novation at risk and, equally important, at risk of falling behind other industrial nations.

Even the President's Council of Advisors on Science and Technology, the PCAST, believes that if the Federal Government continues the present pattern of funding between life sciences and physical sciences, it will, quote, lead to an inability to sustain our Nation's technical and scientific leadership, end of quote. That is why my good friend, Senator Mikulski, and I have led a bipartisan, bicameral effort to double NSF's budget.

I was very pleased that late last year PCAST recommended to the President that, beginning with the fiscal year 2004 budget and carrying through the next 4 fiscal years, funding for the physical sciences and engineering across all relevant agencies be adjusted upward to bring them collectively to parity with life sciences. Further, the President signed the NSF reauthorization bill last fall which authorizes \$6.39 billion for NSF in fiscal year 2004, and called for a doubling of NSF's budget over 5 years.

Therefore, I was deeply disappointed that the budget request only provided \$5.48 billion for fiscal year 2004, a paltry \$170 million or 3.2 percent increase over fiscal year 2003. I have that feeling that Charlie Brown must have had when he asked Lucy to keep holding the football for him.

To say that OMB's budget request for NSF is disappointing would be an understatement. Nevertheless, we intend to continue fighting for additional funds for NSF despite the challenges in meeting funding needs for VA medical care, affordable housing, environmental protection, and space shuttle safety.

Let me just highlight a few areas in the budget. In the area of education, the cut to the TechTalent or STEP program again was disappointing. Senator Lieberman initiated this program along with Senator Mikulski, Senator Frist, Senator Domenici, and myself. At a time when the number of U.S. undergraduates in engineering and mathematics is declining, it is puzzling that the administration would propose a 70 percent reduction in a program designed to increase the number of undergraduates in these fields.

My biggest disappointment, however, is the cut to the plant genome program. Now, you may know I am a big supporter of plant biotechnology because it has generated exciting possibilities for improving human health and nutrition that eventually can be a very powerful tool for addressing hunger in many third world developing countries such as those in Africa and Southeast Asia.

The fiscal year 2004 budget request provides only \$75 million for the NSF plant genome program, a \$10 million cut from the fiscal year 2003 enacted level. The request seems to contradict the National Science and Technology Council's January 2003 report, which recommends the Federal Government invest \$1.3 billion over the next 5 years on plant genome research. The plant genome program deserves more funding, and I hope to be able to address that in the fiscal year 2004 bill.

Let me now touch on a few other issues. First, I am interested in the National Science Board's operations and its implementation of a number of legislative directives enacted in the last Congress to ensure that the Board has tools to meet its statutory responsibilities. For fiscal year 2003, the Congress provided a separate budget

of \$3.5 million to fund the Board's operations but, contrary to law, the administration zeroed out the budget for 2004.

I expect the administration to comply with the statute. For now, I will give the administration the benefit of the doubt that this was a simple oversight, and that the administration will submit a budget amendment to correct this obvious mistake.

Providing the Board with its own budget and hiring authority are two important steps in supporting the Board's independence. In other words, Congress took steps to ensure that the Board not be a rubber stamp for the Director of NSF, or the NSF organization itself. It was to be an independent organization offering advice and guidance and counsel.

But these are only the first steps. We also need to look at the structure of the Board's executive committee. The statute requires the Director to be the chair of the executive committee. It makes more sense to me that the NSB Chair leads the committee.

Before closing, I want to raise a few points about the Foundation's management. Last year before this subcommittee the inspector general raised a number of significant problems with the Foundation's management. Based on my review of the inspector's written testimony submitted for today's hearing, she continues to raise the same concerns, most notably large facility project management.

Over the past 3 years, the IG has conducted two significant audits of NSF's large research facility management, and recommended additional NSF oversight. However, I was disappointed to read in the IG's written testimony submitted today, she states, quote, the key recommendations from both these reports which relate to the development of new project and financial management policies and procedures remain unresolved by NSF management, close quotes.

My view is that NSF must take the management issues more seriously and with greater urgency. I am very pleased the Foundation has finally hired a new deputy director for large facility projects. It is a positive step in the right direction, but clearly more needs to be done, and faster.

Dr. Colwell, you have over a year left in your tenure. During your tenure, I know you have taken a great deal of pride that NSF has achieved a number of scientific policy and scientific goals, and we all benefit from those and we applaud those. All these goals can be overshadowed, however, by management problems if they are not resolved. It is my hope that you will use this year to solve these current management problems, and I think they can be resolved relatively quickly and easily, but the longer they persist, the harder they will be to fix. The long term viability and performance of the agency depends on a solid management and fiscal responsibility.

With that, I conclude my statement, and I will call on first Dr. John Marburger, Director, Office of Science and Technology Policy. Unfortunately, much to your great relief, I had to cut my statement short. Senator Mikulski cut hers short. We are in a food fight on the floor over the supplemental appropriations, so we have regrettably had to impose a time limit on the witnesses today. We will take your entire written testimony and ask that you submit any

further ideas or information in writing. We will have time, I hope, for a round or two of questions.

Dr. Marburger.

STATEMENT OF JOHN H. MARBURGER, III

Dr. MARBURGER. Thank you, Mr. Chairman. I will cut out all of the diplomatic thank yous at the beginning, but I do want to express my appreciation to this committee for your support of science during the past years and the excellent record that you have enabled us to achieve in the sciences in this country. I will summarize my longer written statement.

This budget requests another record-high level of funding for R&D, \$123 billion, or a 7 percent increase over the 2003 request. The proposal does establish priorities. More than \$5.9 billion of the R&D increase is in the Department of Defense development activities, reflecting the President's commitment to bolster our national defense and to win the war against terrorism. In preparing this budget, the administration has taken advice from numerous planning and advisory bodies that exist to guide science priorities, including PCAST, as you mentioned, various committees under the National Science and Technology Council, and Members of Congress, including this committee.

As we produced the fiscal year 2004 budget proposal we did not have final fiscal year 2003 numbers, so we related our budget figures to the President's fiscal year 2003 request. I will make comparisons to that base in my testimony, but I will also refer, where we have the numbers, to the recently passed fiscal year 2003 actual numbers.

So first let me turn to the budget for my Office of Science and Technology Policy. We have primary responsibility in the White House to coordinate interagency research initiatives. The 2004 request for OSTP is \$7.027 million and it includes funding that is not reflected in previous OSTP budgets for rent and security costs associated with our relocation from the Eisenhower Executive Office Building. It also includes additional funding associated with responsibilities that our office has in the area of national security emergency preparedness, so the total new funding in these categories represents \$1.542 million of our 2004 request.

For purposes of comparison, if you take out that sum, our request would represent less than a 2.2 percent increase over the previous levels requested for our core OSTP mission. So I would be glad to answer more questions about the OSTP budget if you have them, but now I would like to turn to highlight the budgets for the agencies for which this Senate committee has oversight.

I am pleased to be here today with the Director of the National Science Foundation, Rita Colwell, and the Chairman of the National Science Board, both of which are important to this committee and to this administration. The 2004 budget request increases the overall NSF budget by \$453 million, or about 9 percent relative to the 2003 request and, as you noted, 3 percent over the enacted 2003 level.

This committee has shown strong support for Federal research in physical sciences, including that conducted under the NSF umbrella. The fiscal year 2004 investment for physical science at NSF

would increase by \$100 million, or 13 percent over the 2003 request. In order to attract and retain more U.S. students into science and engineering, as you noted in your opening remarks, this budget proposal increases individual awards for graduated stipends from \$25,000 to \$30,000 annually. I think Senator Mikulski noted that.

For NASA, the President's request represents a total funding increase of 9 percent, and nearly \$9.2 billion for the Federal science and technology programs, a 5 percent increase over the 2003 request, and 2 percent over the enacted level. The President's commitment to space exploration is evident in this budget, which was conceived before the tragic loss of the Columbia astronauts. The total funding for NASA is proposed to increase 3.1 percent over the 2003 request, and the shuttle budget, after taking into account the transition to full-cost accounting, receives nearly a 5 percent increase over the request for 2003.

We thank the committee for your support for funding in 2003 for the important work of the Columbia Accident Investigation Board, which will produce a report to which we are looking forward very eagerly.

The budget for the Environmental Protection Agency provides \$776 million in the Federal science and technology category. The Agency has appointed a science advisor to improve science integration coordination across this Agency, and I am pleased at the progress that it is making in incorporating science in their recommendations.

There is a small set of priority R&D areas that are targeted in the President's budget request. Let me just list these and the amounts. The first area is combating terrorism, where the President has proposed \$3.2 billion in R&D funding for homeland security. That is across all agencies. More than \$900 million of this funding is requested for the new Department of Homeland Security, including \$803 million specifically in the Science and Technology Directorate in that new Department.

On the computing initiative, the President's proposal includes \$2.2 billion for networking and information technology R&D, a 6 percent increase over last year's request.

The largest increase in this category, interestingly, is in the Department of Health and Human Services, which would increase by \$67 million, or 18 percent above fiscal year 2003, which reflects the importance of bioinformatics in this era of genomics.

The nanotechnology initiative—for that initiative the President's request provides \$849 million. It is a 9 percent increase over the 2003 requested levels. Four new nanoscience research centers in DOE laboratories are included in this year's budget request, which would bring the total number of those nanocenters to five. The President's Council of Advisors for Science and Technology, PCAST, has recently begun a review of this important national program.

Climate change research, another priority—last year the President created the climate change research initiative, designed to accelerate high priority research to support policymaking. The CCRI was combined with the existing U.S. global change research program to create the climate change science program, which is now an interagency effort involving 12 Federal agencies. Funding for



that combined program remains level, but within the program, funds identified for accelerated work for CCRI are increased to \$182 million, as compared with \$40 million in the previous year's request.

#### PREPARED STATEMENT

Finally, math and science education, an important priority for this administration, is reflected in the budgets of the National Science Foundation, Department of Education, and the National Institute of Child Health and Human Development. Special emphasis is placed on the successful development and implementation of evidence-based educational programs and practices as called for in the No Child Left Behind Act of 2002.

I would like to thank you, Mr. Chairman and members of the committee, for your past and future support of my office, and for the Federal research and development enterprise in general. I look forward to answering any questions you may have.

[The statement follows:]

#### PREPARED STATEMENT OF JOHN H. MARBURGER, III

##### FISCAL YEAR 2004 OSTP AND FEDERAL R&D BUDGET

Mr. Chairman and members of the committee, it's a pleasure to meet with you today to discuss the President's fiscal year 2004 request for the Office of Science and Technology Policy (OSTP) and the Federal research and development budget.

As I testified last year, I am committed to maintaining a close and productive relationship with this Committee. I applaud your bipartisan and enduring support of our country's research and engineering enterprise, and look forward to continuing our relationship as we make important choices together to optimize the Federal R&D investment.

The President's budget focuses on winning the war on terrorism, securing the homeland, and strengthening the economy. Considering the context of an uncertain economic environment and growing Federal deficit, any increase in discretionary spending is difficult to justify to the American people. However, the President's budget requests another record high level of funding for R&D: \$123 billion or a 7 percent increase over the 2003 request. Over \$5.9 billion of the increase is in Department of Defense development activities, reflecting the President's commitment to bolster our national defense and homeland capabilities.

This increase in R&D spending is evidence of the great importance the Administration places on science and technology in addressing our country's present and future challenges. The President's budget also continues to emphasize improved management and performance to maintain excellence and sustain our national leadership in science and technology.

In my statement I will review the broad goals of the President's budget and provide detail on OSTP's budget and the Federal research priorities that cut across multiple agencies and research disciplines. My testimony includes comparisons to the President's fiscal year 2003 request, since those numbers were the ones used as a basis during formulation of the fiscal year 2004 budget. I will also attempt to include comparisons with some of the top-level fiscal year 2003 numbers that have more recently become available.

##### THE PRESIDENT'S FISCAL YEAR 2004 R&D BUDGET

Our President has a strong commitment to research and discovery in the national interest. Earlier this year, when we endured the tragic loss of the space shuttle Columbia, the President was unequivocal in his promise that, despite setbacks, the journey of discovery would go on. He said:

"This cause of exploration and discovery is not an option we choose; it is a desire written in the human heart. We are that part of creation which seeks to understand all creation."

The programs in the Federal R&D budget represent some extraordinary new vistas of science with the potential to revolutionize our understanding and our capabili-

ties. We cannot fund everything we'd like, but we will fund those exciting and high priority initiatives that keep this dream of discovery alive, and we will set the stage for the next generation scientists and engineers to take up new challenges that we cannot even imagine.

In preparing this budget, the Administration has taken advice from the numerous planning and advisory bodies that exist to guide science priorities. For example, the budget begins to respond to recommendations by the President's Council of Advisors on Science and Technology (PCAST) and others about needs in physical science and engineering. The budget also reflects an extensive process of consultation between the Federal agencies, OMB, and OSTP, to thoroughly understand agency programs and priorities, interagency collaborations, and directions for the future. The National Science and Technology Council (NSTC), which I will discuss later in my testimony, provided a valuable mechanism to facilitate this interagency coordination. This process resulted in guidance to agencies issued by OSTP and OMB last May, concerning their program planning, evaluation, and budget preparation, and culminating in the budget you see before you today.

The result is a budget that includes a strong emphasis on basic research across the agencies. Basic research is the source of tomorrow's discoveries and new capabilities, and this long-term research will fuel further gains in economic productivity, quality of life, and national security. Included in the budget, and emphasized in my comments today, is the budget category Federal Science & Technology (FS&T). This category, introduced in response to a recommendation of the National Academy of Sciences, excludes most of the development activities in the Federal R&D budget, including Department of Defense development, thereby only highlighting those activities devoted specifically to the creation of new knowledge and technologies.

The budget includes an increase in emphasis on the physical sciences. The physical sciences not only spur understanding of the universe, they are the theoretical foundation for a host of new and promising technologies. Physical science research also offers education and training opportunities vital for a technologically advanced society.

The budget also highlights investments in important research conducted by multiple Federal agencies in a coordinated fashion. Increasingly, the cutting edge of research is not cleanly confined to a specific science discipline, but spans a variety of disciplines or applications. Well-managed interagency collaboration takes advantage of the vast pool of capabilities represented across the Federal Government while minimizing new organizational structures. The high-priority multi-agency R&D initiatives for fiscal year 2004 are: combating terrorism R&D, network and information technology, nanotechnology, research on molecular life processes, climate change research and technology and education research.

#### *Office of Science and Technology Policy (OSTP)*

The Office of Science and Technology Policy has primary responsibility in the White House to coordinate interagency research initiatives. The fiscal year 2004 request for OSTP is \$7,027,000. This figure includes funding not previously reflected in OSTP's budget for rent and security costs associated with our relocation from the Eisenhower Executive Office Building. It also includes increases associated with responsibilities this office has in the area of National Security Emergency Preparedness communications that have received new emphasis. Total new funding in these categories represents \$1,542,000 of our fiscal year 2004 request. For purposes of comparison, if you back out the new funding not previously required, OSTP's fiscal year 2004 request would represent less than a 2.2 percent increase over fiscal year 2003 levels for the core OSTP mission.

#### AGENCY BUDGET HIGHLIGHTS

##### *National Science Foundation (NSF)*

The proposal would increase the overall NSF budget by \$453 million, or about 9 percent relative to the fiscal year 2003 Presidential request, or 3 percent over the enacted fiscal year 2003 level.

- The budget invests heavily in the physical sciences: NSF physical science investments would increase by \$100 million, or 13 percent, over the fiscal year 2003 request. Fundamental discoveries in the physical sciences are needed to spur progress in other areas, such as health research, energy, agriculture and the environment.
- The 2004 budget continues a multi-year effort to improve attraction and retention of U.S. students into science and engineering careers by increasing annual graduate student fellowship and training stipends from \$25,000 to \$30,000 and increasing the number of awards. Reducing the financial burden graduate stu-

dents face can have a significant impact on their choice of science or engineering as a career.

- The Major Research Equipment and Facility Construction program will receive a 60 percent increase from the fiscal year 2003 request to a total of \$202 million in 2004. Simultaneously, NSF is taking a close look at their investments and priorities in research infrastructure, and has, for the first time, provided the Congress with a rank ordering of its approved large facility construction projects and a discussion of how these projects were selected, approved and prioritized.

#### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

The President's request for NASA represents a total funding increase of 9 percent for R&D over the fiscal year 2003 request and nearly \$9.2 billion for FS&T programs, a 5 percent increase over the fiscal year 2003 request and a 2 percent increase over the level enacted for fiscal year 2003.

- The President's commitment to space exploration is evident in this budget, which was conceived before the tragic loss of the Columbia astronauts. Total funding for NASA is proposed to increase 3.1 percent overall. The Shuttle budget, after taking into account the transition to full cost accounting, receives nearly a 5 percent increase over the fiscal year 2003 request.
- Included in the \$4 billion in space science programs are several initiatives to increase the scientific and educational outcomes of future planetary missions, such as a new \$31 million investment in optical communications technology and a \$279 million investment in Project Prometheus, to include the development of propulsion systems that will enable exploration of our solar system's most distant planets.

#### *Environmental Protection Agency (EPA)*

The budget provides \$776 million in the FS&T budget for EPA, essentially maintaining funding at the level requested in the fiscal year 2003 Budget, a 3 percent decrease from the level enacted for fiscal year 2003.

- The EPA budget supports significant efforts to continue to improve the scientific base in support of policy and regulations through: improvement in the use of science by the regional offices; ongoing efforts to attract and maintain a high-quality, diverse scientific workforce; and assessments to ensure the quality and consistency of science.
- Responding to concerns about the adequacy of its science, EPA has appointed an agency Science Advisor to improve environmental science integration and coordination at EPA.
- The President's Budget provides nearly a four-fold increase in funding to improve the Integrated Risk Information System (IRIS), a database which contains toxicity information of chemicals. IRIS is used by other Federal agencies, States, and international officials to help assess the potential health risks of chemicals and to develop regulations.

#### INTERAGENCY INITIATIVES

Beyond the individual agency initiatives, the President's budget outlines priority areas of research involving multiple agency participation. Last May, OMB Director Mitch Daniels and I sent out an fiscal year 2004 budget-planning memo to agencies to provide guidance and focus for these budget priorities. National R&D priorities set forth in the guidance memo include: R&D for Combating Terrorism, Networking and Information Technology, Nanotechnology, Climate Change, Molecular Life Processes and Education.

A mechanism for coordinating interagency initiatives lies within the President's National Science and Technology Council (NSTC), and my office has responsibility for the day-to-day operations of the NSTC. This Cabinet-level Council is the principal means for the President to coordinate science, space, and technology, bringing together the diverse parts of the Federal research and development enterprise. The Council prepares research and development strategies that are coordinated across Federal agencies to form an investment package aimed at accomplishing multiple national goals. The following describe high priority interagency initiatives the NSTC helps to coordinate:

*Combating Terrorism.*—Last month the Department of Homeland Security opened its doors for business. Standing up the new Department is a massive undertaking and one of the highest priorities of this Administration. The President has proposed \$3.2 billion in research and development funding for homeland security and combating terrorism across the Federal Government. Over \$900 million is requested for

combating terrorism research and development in the new department, including \$803 million in the S&T directorate. This investment will be focused on robust research, development, testing, evaluation and systems procurement to ensure both evolutionary and revolutionary capabilities.

The National Science and Technology Council's Committee on Homeland and National Security will work with the Homeland Security Council, the National Security Council, the Office of Management and Budget, the Department of Homeland Security and other relevant departments and agencies to identify priorities for and facilitate planning of homeland and national security R&D. The coordinated Federal effort will emphasize:

- Strategies to combat weapons of mass destruction, including radiological and nuclear countermeasures and biological agent detection, diagnostics, therapeutics, and forensics;
- Information analysis;
- Social, behavioral, and educational aspects of combating terrorism;
- Border entry/exit technologies; and
- Developing standards relevant to both homeland and national security.

*Networking and Information Technology.*—The President's 2004 budget provides \$2.2 billion for the Networking and Information Technology R&D Program (NITRD). This is a 6 percent increase over the fiscal year 2003 request. The largest increase above 2003 NITRD request level is proposed for the Department of Health and Human Services, which would increase by \$67 million, or 18 percent. The increased life sciences budget reflects the growing importance of bioinformatics R&D—efforts at the intersection between biology and information technology—in furthering biomedical research. NSF maintains the largest share of NITRD program funding and the budget proposes a \$45 million, or 7 percent, increase over the fiscal year 2003 request.

Agencies involved in developing or using high end computing are engaged in planning activities coordinated through the National Science and Technology Council's Committee on Technology. In 2004, NITRD research emphases include:

- Network "trust" (security, reliability, and privacy);
- High-assurance software and systems;
- Micro- and embedded-sensor technologies;
- Revolutionary architectures to reduce the cost, size, and power requirement of high end computing platforms; and
- Social and economic impacts of information technology.

*National Nanotechnology Initiative.*—The President's 2004 budget provides \$849 million for the multi-agency National Nanotechnology Initiative (NNI). This is a 9.8 percent increase over levels requested for 2003. The Office of Science at the Department of Energy almost triples its investment in new nanoscale science research centers, with a proposed increase of \$63 million to begin design and construction on four new nano-science research centers, bringing the total number of funded nano-centers to five. NSF continues to have the largest share of Federal nanotechnology funding, reflecting the broad mission of NSF in supporting fundamental research across disciplines, and the budget for NIH nanotechnology activities is increased by almost 8 percent relative to the fiscal year 2003 request. Altogether, 10 Federal agencies cooperate in the nanotechnology initiative with activities coordinated through the National Science and Technology Council's Committee on Technology. The NNI strategy for 2004 involves further investment in fundamental research across the range of scientific and engineering disciplines through investments in investigator-led activities at colleges and universities, centers of excellence, and supporting infrastructure.

Responding to a recent National Research Council recommendation, next month the President's Council of Advisors for Science and Technology (PCAST) will begin conducting an ongoing, external review of the NNI aimed at strengthening the program and helping to identify and measure progress toward strategic goals.

*Climate Change.*—Last year, to advance climate change science objectives, President Bush created the Climate Change Research Initiative (CCRI). The CCRI was combined with the existing US Global Change Research Program (USGCRP) to create the Climate Change Science Program (CCSP), an interagency research effort involving 12 Federal agencies. While funding for the combined CCSP remains level with the fiscal year 2003 request, the funds identified for CCRI is increased to \$182 million as compared with \$40 million requested for fiscal year 2003. The CCRI investment will develop resources to support policy making, provide computer resources for climate modeling for decision support studies, and enhance observations and data management for a climate observing system. The increase for CCRI is the result of a process that has focused on managing GCRP funding more effectively and refocusing some research toward CCRI goals. A draft strategic plan for the

CCSP has been produced and vetted through the science community using a multi-day public workshop held in December 2002 and in an open comment period. The response was overwhelmingly in support of the new management approach to the Federal program on climate change. A final strategic plan, relying on the extensive analysis and commentary resulting from the workshop, will be produced this spring and will guide the future activities of the program.

\$40 million is identified for the National Climate Change Technology Initiative (NCCTI) Competitive Solicitation program—an innovative approach for funding technology research and development to reduce, avoid or sequester greenhouse gases. In 2004, government-wide spending on climate change technologies will be reviewed, and priority programs for emphasis in the NCCTI will be identified.

*Math and Science Education—No Child Left Behind.*—The improvement of pre-K–12 math and science education remains a major Administration priority, with special emphasis on the successful development and implementation of evidence-based educational programs and practices, as called for in the No Child Left Behind Act of 2002. The President's 2004 budget request includes support for two such programs involving the Federal research agencies: the Math and Science Partnership (MSP) Program and the Interagency Education Research Initiative (IERI). The MSP request for NSF is \$200 million, and for the Department of Education is \$12.5 million. The program funds new and ongoing partnerships between institutions of higher education and local school districts. This program also will fund teacher training summer institutes for more intense immersion into mathematics and science content areas.

The funding request for the IERI remains level with the President's 2003 budget request. The goal of the IERI is to improve pre-K–12 student learning and achievement in reading, math and science by conducting research on the scaling of educational practices that have already demonstrated their effectiveness in studies conducted with a limited number of students or classrooms. Currently the NSF, the Department of Education, and the National Institute of Child Health and Human Development (NICHD) participate in IERI.

Additionally, the 2004 budget includes a \$10 million increase in research, development, and dissemination funding for the Department of Education's new "Institute of Education Sciences"—from \$175 to \$185 million.

Recognizing the need for better coordination of educational activities between the Federal research agencies, the National Science and Technology Council's Committee on Science has formed a Subcommittee on Education. This subcommittee will advise on best practices and will develop strategies to move agency programs away from fragmentation and duplication of effort towards a coordinated, complimentary set of individual agency and interagency programs.

#### MANAGING THE FEDERAL RESEARCH BUDGET

Equal in importance to the spending on the Federal research budget is the management of this investment. In addition to providing funding coordination, the NSTC will also be reviewing management aspects of research including:

- Analysis and recommendations concerning the requirements for Federal investment in major research facilities and infrastructure, and the best management practices to determine priorities and allocate funding; and
- An investigation of the changing business model for research, and recommendations for modernizing the management and funding of Federal research programs in response to this changing research environment.

The fiscal year 2004 budget emphasizes increased return on investment by improvements in management, performance and results of the research programs. Working together and with the Federal research agencies, OMB and OSTP are developing, implementing, and continuing to improve investment criteria for research programs across the government. Explicit R&D investment criteria have been developed to improve R&D program management, better inform R&D program funding decisions, and ultimately increase public understanding of the possible benefits and effectiveness of the Federal investment in R&D. In 2004, all R&D program managers must demonstrate the extent to which their programs meet the following three tests:

- Relevance.*—R&D programs must be able to articulate why the investment is important, relevant, and appropriate. This must include complete planning with clear goals and priorities, clearly articulated societal benefits, and the mechanisms used for reviewing and determining the relevance of proposed and existing programs.
- Quality.*—R&D programs must justify how funds will be allocated to ensure quality. Agencies must maximize quality through clearly stated, defensible

methods for awarding a significant majority of their funding. Programs must assess and report on the quality of current and past R&D.

—*Performance.*—R&D programs must be able to monitor and document how well the investments are performing. This includes tracking and reporting annually on objectives and milestones for relevant programs, and defining appropriate measures of performance, output, and outcome.

As a result of implementing these criteria, and consistent with the Government Performance and Results Act, the Administration strives to ensure that every dollar is invested as effectively as possible. Based on lessons learned and other feedback, the Administration will continue to improve the R&D investment criteria and their implementation towards more effective management of the Federal R&D portfolio.

#### CONCLUSION

Mr. Chairman and members of the committee, I believe this is a good budget for science and technology. I hope I have conveyed to you the extent of this Administration's commitment to advancing science and technology in the Nation's interest. I look forward to our work together as we move towards implementing a national science and technology strategy that will draw from the best in industry, academia, the non-profit sector, and all levels of government. The programs that we discuss today will help us protect our citizens and our national interests, advance knowledge, promote education, and preserve the dream of exploration and discovery. I would be pleased to respond to questions about this budget.

Senator BOND. Thank you very much, Dr. Marburger. That was excellent timing. You came out right on the money. Now we turn to Dr. Colwell. Welcome, Doctor.

#### STATEMENT OF RITA R. COLWELL

Dr. COLWELL. Chairman Bond, your consistent support and strong leadership has led to record increases for the Foundation's budget in the omnibus appropriations passed in February, and I speak for everyone at NSF when I say how grateful we are for your efforts. We thank you.

Before I begin with a brief overview of this year's budget, I would like to first relate to you some actions we have taken in response to concerns that you raised last year. First, we provided a prioritized list of all major research, equipment, and facilities construction projects that have been approved by the National Science Board and it is included in our budget.

Second, we've provided support to the National Academy of Sciences to assess setting priorities for major research equipment. We have hired a new deputy for our large facilities projects, Dr. Mark Coles. He will report to the chief financial officer, and will be a tremendous asset to NSF, and available for inquiry from you and your staff.

We have an active facilities oversight and guidelines manual vetted with both the National Science Board and the community. New comments have been received and are being incorporated into the next version of the guide, scheduled for release May 31.

We have a risk assessment guide for award oversight, vetted with the Science Board, drawn from other agencies' best practices, and we have taken the suggestions of the IG to heart, and we are incorporating more specific guidance to your staff.

We began making site visits last year using this risk model, and we have begun training staff in its use and making continuous improvements as we go along.

We have put in place procedures and guidelines to ensure the integrity of the taxpayer's money, attested to by the IG's clean audit opinion issued in January of this year, and my CFO has an active

plan in place to close out the remaining audit recommendations for large facilities projects by September 30 of this year, and I appreciate the effort that you and your staff have made on these issues, and I believe the results will be beneficial.

The NSF budget proposal for 2004 leaves no doubt that the President embraces the conviction that the surest way to keep our Nation prosperous and secure is to keep it at the forefront of learning and discovery. Our highest priority is maintaining the quality of U.S. science and engineering, and the 2004 budget includes \$200 million for the Math and Science Partnership program, which is a centerpiece of the President's No Child Left Behind initiative.

To attract more of the most promising U.S. students to science and engineering graduate programs we have proposed a stipend increase to \$30,000, and we thank you for your support, because this builds on making available graduate study attractive and affordable to talented American students, and this year's budget also increases support for our STEP/TechTalent program to improve the Nation's production of science and engineering majors.

We are also requesting \$16.2 million for the CyberCorps program to train future Federal employees in information assurance and computer security. We have initiated a 21st century workforce focus to attract U.S. students to science and engineering fields and to broaden participation. We are going to fund three new Science of Learning Centers—again, I thank you for your support—to investigate how people learn, capitalizing on recent progress in cognitive science, neuroscience, and information technology.

We are also proposing a substantial increase in funding for the physical sciences, providing over \$1 billion to sustain the vigorous research that has helped power advances in medicine, energy, agriculture, and understanding the environment, and I know you are very supportive of that.

One hundred million dollars has been requested for biocomplexity in the environment, including support for microbial genome sequencing and the ecology of infectious diseases, which are also areas of vital importance to antiterrorism efforts, and an \$89 million investment in the mathematical sciences and statistics priority area will improve our ability to handle the massive data sets produced by today's sensors and observation systems and to model and manage uncertainty.

Building on previous investments in the social, behavioral and economic sciences, we are requesting \$24 million to launch a human and social dynamics priority area that will investigate the impacts of change on our lives and the stability of our institutions. The largest dollar increase in NSF's 2004 budget is in tools. Our request of \$1.34 billion will help meet the growing needs for small and mid-sized equipment and instrumentation as well as major facilities, as was enunciated by Senator Mikulski just a minute ago.

Our investment record is excellent. NSF puts its money where it will do the most good. Ninety-five percent of our budget goes directly to research and education to keep the knowledge base active, the economy humming, and benefits to society flowing. In addition, every dollar invested in academic institutions also contributes to recruiting and training the next generation of researchers and to ensure a well-informed citizenry.

Nevertheless, I have to point out, as our budget has expanded in recent years, so have our oversight obligations, yet NSF staffing levels have not changed in over a decade. We remain concerned that the Foundation has the human and capital resources necessary for responsible stewardship of our growing portfolio.

#### PREPARED STATEMENT

Mr. Chairman, I ask for your support for our fiscal year 2004 budget request, and I really want you to know how much the Foundation appreciates you and the committee's longstanding bipartisan support. I ask that my written testimony and a summary of the National Science Foundation's budget request be included for the record, and I will be very happy to answer any questions that you may have.

[The statement follows:]

#### PREPARED STATEMENT OF RITA R. COLWELL

Chairman Bond, Senator Mikulski and Members of the Committee, I am pleased to appear before you today. For more than 50 years, the National Science Foundation (NSF) has been a strong steward of America's science and engineering enterprise. Although NSF represents less than 4 percent of the total Federal budget for research and development, it accounts for one-fifth of all Federal support for basic research and 40 percent of support for research at academic institutions, excluding the life sciences. Despite its small size, NSF has an extraordinary impact on scientific and engineering knowledge and capacity.

During NSF's five decades of leadership, groundbreaking advances in knowledge have reshaped society and enabled the United States to become the most productive Nation in history. The returns on NSF's strategic investments in science, engineering, and mathematics research and education have been enormous. Much of the sustained economic prosperity America has enjoyed over the past decade is the result of technological innovation—innovation made possible, in large part, by NSF support.

In our 21st century world, knowledge is the currency of everyday life, and at the National Science Foundation we are in the knowledge business. Our investments are aimed at the frontiers of science and engineering research and education, where advances in fundamental knowledge drive innovation and progress.

Today, our Nation faces significant challenges—in security, health, the economy, and the workforce. The surest way to keep our Nation prosperous and secure is to keep it at the forefront of learning and discovery. The NSF budget proposal for fiscal year 2004 aims to do just that, and I am very pleased to present it to you today.

I'll begin with the big picture. This year the National Science Foundation is requesting \$5.48 billion. That's an additional \$453 million, or 9 percent more than last year's request.

This budget leaves no doubt that the President embraces NSF's vision and value. NSF-funded research and education will help us meet the economic and national security challenges facing us at home and abroad, now and in the future.

NSF has been growing—surely and steadily. Our investments this year put us on the right path, and with the leadership and vision of this Committee, the NSF Authorization Act, signed by the President in December, will keep us moving in the right direction in the years to come.

To promote the progress of science, NSF invests in three strategic areas.

*People.*—Facilitating the creation of a diverse, internationally competitive, and globally engaged workforce of scientists and engineers and well-prepared citizens is NSF's first priority. To achieve this goal, NSF supports improvement efforts in formal and informal science, mathematics, engineering, and technology education. Across its science, mathematics, engineering, and technology research and education programs, NSF works to enhance the diversity of our science and engineering workforce. The Foundation provides support for almost 200,000 people, including students, teachers, researchers, post-doctorates, and trainees.

*Ideas.*—Investments in ideas support cutting edge research and education that yield new and important discoveries and promote the development of new knowledge and techniques within and across traditional boundaries. These investments help maintain America's academic institutions at the forefront of science and engi-



neering. The results of NSF-funded projects provide a rich foundation for broad and useful applications of knowledge and development of new technologies. Support for ideas also promotes the education and training of the next generation of scientists and engineers.

*Tools.*—NSF investments provide state-of-the-art tools for research and education, including instrumentation and equipment, multi-user facilities, digital libraries, research resources, accelerators, telescopes, research vessels and aircraft, and earthquake simulators. These tools also include large surveys and databases as well as computation and computing infrastructure for all fields of science, engineering, and education. Support for these unique national facilities is essential to advancing U.S. research and education.

Of course, People, Ideas and Tools work together to give us the best returns in discovery, learning and innovation.

Before providing a few highlights of the budget, let me stress that the priority-setting process at NSF results from continual consultation with the research community. New programs are added or enhanced only after seeking the combined expertise and experience of the science and engineering community, the Director and Deputy, and the National Science Board.

Programs are initiated or enlarged based on considerations of their intellectual merit, broader impacts of the research, the importance to science and engineering, balance across fields and disciplines, and synergy with research in other agencies and nations. NSF coordinates its research with our sister research agencies both informally—by program officers being actively informed of other agencies' programs—and formally, through interagency agreements that spell out the various agency roles in research activities. Moreover, through our Committee of Visitors process there is continuous evaluation and feedback of information about how NSF programs are performing.

Producing the finest scientists and engineers in the world and encouraging new ideas to strengthen U.S. leadership across the frontiers of discovery are NSF's principal goals. NSF puts its money where it counts—95 percent of our budget goes directly to the research and education that keep our knowledge base fresh, our economy humming and the benefits to society flowing.

Each year, NSF funds about 33,000 proposals at the leading edge of research. And we support more than 200,000 students, teachers, and researchers.

Investing in People is key to developing the Nation's full talent and maintaining the quality of our workforce. There is no better place to begin than with our children. We must ensure that every child can participate in the Nation's prosperity and contribute to its progress.

The budget includes \$200 million for the Math and Science Partnership program, a key component of the President's No Child Left Behind initiative. This is the third installment of a \$1 billion, 5-year investment to raise the performance of all U.S. students in mathematics and science. The program links local schools with colleges and universities to improve teacher performance and provide a challenging curriculum for every student. And it creates innovative ways to reach out to underserved students and schools.

Our Nation's science and engineering workforce is the most productive in the world. To keep it that way, we have to attract more of the most promising students to graduate-level studies in science and engineering.

We have been steadily increasing stipend levels from a low of \$15,000 in 1999, and it's working. Applications for graduate fellowships increased by 19 percent between 2001 and 2002. This year, we are requesting an increase to \$30,000. And, we will also increase the number of fellowships.

Opportunities to advance knowledge have never been greater than they are today. NSF invests in emerging areas of research that hold exceptional potential to strengthen U.S. world leadership in areas of global economic and social importance. This year, we are requesting funding for six of these priority areas: biocomplexity, information technology, nanoscale science and engineering, mathematical sciences, human and social dynamics, and the 21st century workforce.

The budget includes a \$100 million request for research in Biocomplexity in the Environment. This investment will continue support for microbial genome sequencing and the ecology of infectious diseases, two areas that are of vital importance to the Nation's anti-terrorism efforts. Research that charts the interactions among physical, human, and other living systems, will improve our ability to understand and manage our environment. The development of new technologies and tools rounds out this investment.

As the lead agency in two of the Administration's top interagency R&D efforts, NSF has provided an investment of \$724 million in Networking and Information

Technology Research and Development and \$249 million in the National Nanotechnology Initiative.

Our priority area investment in Information Technology Research of \$303 million will advance every field of science and add to our economic prospects. We propose to expand fundamental research in high-end computation and large-scale networking. Other investments address the need for safe and dependable information systems for national security and consumer protection. To reap the educational benefits of the information revolution, we plan to focus on the use of cutting-edge IT research in the classroom.

The emerging field of nanoscale science and engineering promises a revolution at least as far-reaching as the one we've witnessed in information, computer and communications technologies. The ability to manipulate and control matter at the atomic and molecular levels will open new possibilities in materials and manufacturing, medicine, environment and energy, and national security. As the lead agency in the National Nanotechnology Initiative, NSF is requesting \$249 million to expand basic research on new materials, biological systems at the nanoscale, and quantum computing. We will address the need to build capacity through investments in centers, training programs, and equipment. Research on the social and educational impacts of nanotechnology can prepare us to make the best use of new applications.

Mathematics is the lingua franca, or as I like to say, the Esperanto of science and engineering. It leads us to new and deeper insights in every discipline. We propose to invest \$90 million in the Mathematical Sciences priority area to pursue fundamental research in the mathematical sciences and statistics, and programs that will bring cutting-edge mathematical and statistical techniques to all fields.

This investment will improve our ability to handle the massive data sets produced by today's sensors and observation systems, and to model and manage uncertainty. We also propose to strengthen connections between research and education in the mathematical sciences.

Building on previous investments in the social, behavioral, and economic sciences, NSF proposes to launch a Human and Social Dynamics priority area. An investment of \$24 million will fund research and new techniques to deepen our understanding of the impacts of change on our lives and on our institutions. The request will help us build the large-scale databases and refined research methods needed for major progress in the social sciences.

Research will improve our understanding of how people make decisions, take risks, and deal with uncertainty. We will also support studies of large-scale change, such as globalization, the evolution of society and its interaction with the environment, and the implications of culture for conflict and assimilation.

The Nation needs both world-class scientists and engineers, and a workforce that has the scientific and technical skills needed to thrive in today's changing workplace.

NSF is requesting \$8.5 million to begin the development of a Workforce for the 21st Century priority area to address three critical national science and engineering workforce needs: preparing scientists and engineers capable of meeting the challenges of the 21st century; attracting more U.S. students to science and engineering fields; and broadening participation in science and engineering. We will fund Integrative Institutional Collaborations that bring together and integrate NSF educational activities that work—the Louis Stokes Alliances for Minority Participation (LSAMP) program, Graduate Teaching Fellowships in K–12 Education (GK–12), the Integrative Graduate Education Research Traineeships (IGERT) program, Research Experiences for Undergraduates (REU), and Centers of Research Excellence in Science and Technology (CREST) program, for example.

We will expand research opportunities for students and faculty from high schools and from 2-year and 4-year colleges. Our investments will emphasize efforts to build stronger links between research and education at historically black colleges and universities and minority-serving institutions.

Every year it becomes more difficult to choose only a few NSF activities to highlight in the budget presentation. But they are all genuinely significant, and I want to make brief comments about each.

Our Nation is facing new and difficult challenges in homeland security. The NSF budget includes investments that will help us meet growing security needs. I've already mentioned programs in microbial genome sequencing and the ecology of infectious diseases. The Scholarships for Service program will train students in information security and assurance, in exchange for service in Federal Government agencies. Vital research in the Critical Infrastructure Protection program is designed to pinpoint vulnerabilities and strengthen protection for the Nation's power grids, transportation networks, and water supply systems. A diverse portfolio of security-

related information technology research rounds out the NSF contribution. Every one of these investments will have a big payoff.

This year, the NSF budget places special emphasis on investments in the physical sciences. We propose a 12.7 percent increase that will bring total funding in areas such as physics, chemistry, mathematics, and materials research to over \$1 billion. We need this investment to spur the fresh and vigorous research in these fields that has helped in the past to power advances in medicine, energy, agriculture, and the environment.

As part of the President's multi-agency Climate Change Research Initiative, NSF will support focused research to reduce uncertainty in critical areas of climate change knowledge and provide timely information for policy decisions. We are requesting \$4.5 million to establish 3 or more new centers to improve understanding of risk management, risk communication, and decision-making. These studies will complement NSF's ongoing programs in climate change science.

We know that diversity gives strength to the fabric of our society. The NSF request places special emphasis on broadening participation in science and engineering. The Historically Black Colleges and Universities (HBCU) Undergraduate Program increases by 43 percent, the Louis Stokes Alliance for Minority Participation, which helps minorities toward undergraduate degrees in science and engineering, and the ADVANCE program, aimed at more diversity among successful scientists with family responsibilities, will both increase by 23 percent, and finally, the Partnerships for Innovation program, which transfers knowledge from research and education into the creation of new wealth by strengthening local and regional economies, will double its budget to \$10 million.

We are requesting \$105 million for the EPSCoR program to continue building the capacity of educational institutions so that they can participate more fully in NSF research activities.

The Noyce Scholarships address the shortage of highly trained K-12 teachers by providing scholarships to talented mathematics, science, and engineering students who wish to pursue teaching careers in elementary or secondary schools.

This year, our budget provides \$75 million to support ongoing research on the genomics of plants of major economic importance. This includes a program of Young Investigator Awards in Plant Genome Research.

The Science, Technology, Engineering and Mathematics Talent Expansion Program, or STEP, provides grants to colleges and universities to establish programs to increase the number of undergraduate math and science majors. We are requesting \$7 million for the program this year, an increase of \$5 million, or 250 percent, over the request for fiscal year 2003.

The National Science Foundation furthers its research efforts by entering into partnerships with other Federal agencies and regards these partnerships as a core strategy for enabling Foundation activities. As part of the Administration's multi-agency Climate Change Research Initiative, NSF will support research to reduce uncertainty in critical areas of climate change knowledge and provide timely information to facilitate policy decisions. The total fiscal year 2004 investment for CCRI increases by \$10.0 million to a total of \$25.0 million.

Finally, the budget provides \$20 million to fund three or more new Science of Learning Centers. These centers will build on advances in the social sciences, computer science, engineering, and neuroscience to investigate how people learn, how the brain stores information, and how best to use information technology to promote learning. The aim is to bring fresh knowledge to the design of learning environments.

The most significant dollar increase in NSF's fiscal year 2004 budget is in Tools, with a total investment of \$1.34 billion, a \$219 million increase over last year's request. Rapidly changing technology and increasing demand for state-of-the-art tools have put tremendous strain on the Nation's laboratories and research facilities. We need to renew our science and engineering infrastructure across the board, large and small. For the first time, in order to help Congress better understand our future planning needs, our budget provides a prioritization of all ongoing and planned major facility construction approved by the National Science Board.

NSF plans to invest in major research equipment and facilities construction projects over the next several years. One new start, ocean drilling, is planned for fiscal year 2005, with two new starts, Rare Symmetry Violating Processes (RSVP) and Ocean Observatories, for fiscal year 2006.

I want to emphasize that the \$220 million increase in Tools is distributed across all of NSF's programs. It includes a new \$20 million CyberInfrastructure investment to bring next-generation computer and networking capabilities to researchers and educators nationwide. Other investments, in mid-sized and small equipment, for example, also receive a healthy portion of the increase.

In making these critical investments, NSF continues to put a very strong emphasis on effective and efficient management. We are proud of our track record.

Mr. Chairman and Members of the Committee, I hope that this brief overview conveys to you the extent of NSF's commitment to advancing science and technology in the national interest.

I ask not only for your support for our fiscal year 2004 budget request, but also want you to know how much I appreciate the long-standing bipartisan support of the committee for NSF. Mr. Chairman, I would ask to include a copy of NSF's budget summary as part of my testimony, and would be happy to answer any questions that you have.

Senator BOND. Thank you very much, Dr. Colwell. We are excited about the tremendous things that are going on, and appreciate very much your comments and your testimony.

Now I would like to turn to Dr. Warren Washington, who is Chair of the National Science Board.

#### STATEMENT OF WARREN M. WASHINGTON

Dr. WASHINGTON. Chairman Bond, I appreciate the opportunity to testify before you as the Chair of the National Science Board. Our National Science Board approved and supports the National Science Foundation's budget submission for fiscal year 2004. We fully support the Foundation's investment in six priority areas. The Board believes it is crucial to maintain a strong portfolio of investment in the core disciplines, and it is also crucial that as the Foundation's research portfolio increases the funds for award administration should be sufficient to maintain efficient and effective NSF management of the portfolio.

The Board and the Director continue to work effectively together and the Board is fully engaged in its policy and oversight responsibilities. The Board establishes policies for the Foundation, approves budgets, major new programs, agreements, and awards. It also includes the oversight for the Foundation's administrative processes and systems.

In November 2002, the Board approved the resolution on guidelines for setting priorities for major research facilities. A copy of that resolution with revised guidelines is attached to my written statement. The Board establishes priority order for the facility construction projects based upon set guidelines.

Let me comment on some other Board actions. We are currently in the process of selecting an executive officer. Our intent is to complete the selection soon after our May board meeting, and after the executive officer has been selected I plan to address the other staffing issues.

Senator Bond, at the previous hearing a year ago, you asked about openness. I am pleased to report that all board meetings, subcommittee and task force meetings, as well as the full board meetings are now open to the public, except for a very few portions that fall under the exceptions in the Sunshine Act. The new openness has been embraced by the board members and well received by the press and members of the public.

The Foundation's 2003 appropriations act provided a separate budget of \$3.5 million for Board operations and activities in this fiscal year, and the accompanying conference report requested budget justification materials in support of the Board's 2004 budg-

et. We are allocating the first time appropriation for fiscal year 2003.

On the matter of the fiscal year 2004 budget, the Board's first meeting since the appropriations bill was signed took place in early March. There was limited opportunity for members to discuss the full range of options in this legislation. However, it is my intent to prepare the budget justification materials for fiscal year 2004 as requested in the conference report. At our May meeting, I have scheduled time for thorough discussion of the issues, and I will inform you of our plans as soon as possible after that meeting.

The Board is nearing the completion of two policy reports. Our Task Force on Science and Engineering Infrastructure has assessed the status, changing needs and strategies to ensure that the Nation will have science and engineering infrastructure needed, and this report will be released April 9. The Board's Task Force on National Workforce Policies for Science and Engineering has been studying U.S. science and engineering workforce needs and our national policy for ensuring a skilled workforce in the future, and we anticipate that this will be available in a couple of months. Any comments that you have on that will be especially valuable.

#### PREPARED STATEMENT

At this point, I would like to end my formal remarks, and I want to thank you for the opportunity to testify on budget issues and the Board's policy activities. I ask that my complete statement be included in the record. I am pleased to answer any questions. Thank you.

Senator BOND. Thank you very much, Dr. Washington. And of course, we will have your complete statement for the record.

[The statement follows:]

#### PREPARED STATEMENT OF WARREN M. WASHINGTON

Chairman Bond, Senator Mikulski, and Members of the Committee, I appreciate the opportunity to testify before you as Chair of the National Science Board. I am Warren Washington, Senior Scientist and Section Head of the Climate Change Research Section at the National Center for Atmospheric Research.

On behalf of the National Science Board, I thank the Committee for its long-term commitment to a broad portfolio of investments in science, mathematics, engineering, and technology research and education. These investments are important components of our Nation's security and economic strength and the well being of all Americans.

For more than 50 years, the National Science Foundation has been a major contributor to innovative science and engineering research and education. The Congress recognized these valuable contributions through the passage of the 5-year reauthorization bill last year, with steady and substantial increases in authorized budgets for the agency. This recognition is greatly appreciated.

The National Science Board approved and supports the National Science Foundation's budget submission for fiscal year 2004. We assure you that the \$5.48 billion will be well spent. We fully support the Foundation's investment in the six priority areas of biocomplexity, information technology, nanoscale science and engineering, mathematical sciences, human and social dynamics, and the 21st century workforce. These areas hold exceptional promise for new discoveries, educational opportunities, and practical applications.

The Board also believes it is crucial to maintain a strong portfolio of investments in the core disciplines. The increased funds received for fiscal year 2003 will strengthen the core research and education programs. The Foundation's fiscal year 2004 budget request recognizes the need to increase funding to the physical sciences and includes a 12.7 percent increase for physics, chemistry, mathematics, and materials research.

It is crucial that, as the Foundation's research portfolio increases, the funds for award administration increase sufficiently to maintain effective and efficient NSF management of the portfolio.

Since 1950, the partnership explicitly spelled out in the founding documents between the National Science Board and the Foundation's Director has worked extremely well, and the Nation's science and engineering research and education have flourished. Although recent legislation has altered some administrative aspects of our partnership, I can assure you that we continue to work together effectively and that the Board remains fully engaged in its policy-making and oversight responsibilities for the agency. The full Board sets Foundation policy after detailed consideration of recommendations made by its committees. These standing bodies deliberate with great thoroughness and thoughtfulness about the numerous programmatic and managerial issues facing the agency.

- Our Committee on Programs and Plans is responsible for program initiatives and major new projects and facilities, proposed awards, and major program implementation issues (in all fields except those pertaining to education and human resources).

- Our Education and Human Resources Committee addresses matters dealing with education and training and the technical workforce.

- Our Audit and Oversight Committee is responsible for administrative processes and systems and also serves as the supervisor of the Inspector General.

- Our Committee on Strategy and Budget examines strategic budget matters and identifies long-term issues critical to the Foundation's future.

This last committee, the Committee on Strategy and Budget, was established in May 2001 to strengthen the Board's role in the Foundation's strategic budget process. The Committee identifies long-term issues that are critical to the Foundation's future and analyzes strategic and operating budgets to ensure progress toward strategic directions set by the Board. The Committee has worked with other Board members and Foundation staff on strategic issues such as management of the Major Research Equipment and Facilities Construction (MREFC) Account, support for the core disciplines, and the size and duration of graduate student and postdoctoral stipends.

When I appeared before this Committee a year ago, Committee members expressed concern about the Board's involvement in setting priorities for funding projects through the MREFC Account. I would like to bring you up to date on that issue while illustrating the effectiveness of the Committee on Strategy and Budget.

First, let me state that the Board continues to approve each project to be funded from the MREFC Account before the funds are obligated. Our Committee on Programs and Plans thoroughly reviews any proposed MREFC funding and brings recommendations to the full Board. There is ample opportunity for Board members to raise concerns before a vote is taken.

Throughout 2002, the Committee on Strategy and Budget discussed how best to accommodate within future budgets the initiation of new major research facilities that the community and Foundation identified as important to the advancement of science and engineering. In August the Committee, in collaboration with the Committee on Programs and Plans, set up a joint working group to determine whether changes to existing Board guidance on priority setting might be appropriate. Policy options developed by the group were discussed in October 2002 by the Board's Committee on Strategy and Budget and Committee on Programs and Plans.

In November 2002, the two committees brought a proposed resolution to the Board, the Resolution on Guidelines for Setting Priority for Major Research Facilities (NSB-02-189), and it was approved by the full Board. (A copy of the resolution with revised guidelines is attached.) We are working closely with Foundation management as the Large Facility Projects Management and Oversight Plan is implemented. We are pleased to see that a Deputy Director for Large Facility Projects has been hired, and we expect that he will report to the Board on a regular basis.

The Board's Major Research Facilities guidelines state that when considering a project for approval, the Board will review the need for such a facility, the research that will be enabled, readiness of plans for construction and operation, construction budget estimates, and operations budget estimates. The Board then establishes a priority order for facility construction projects, based on these guidelines:

- Highest priority is given to projects already under construction, as long as progress is appropriate.

- New candidate projects are considered from the point of view of broadly serving the many disciplines supported by the Foundation.

- Multiple projects for a single discipline, or for closely related disciplines, are ordered based on a judgment of the contribution that they will make toward the

advancement of research in those related fields. Community judgment is considered.

- Projects are authorized close to the time that funding requests are expected to be made.
- International and interagency commitments are considered in setting priorities among projects.

Let me comment on some other Board actions. We are currently in the process of selecting an Executive Officer. After conducting a national search for candidates, a short list has been developed for further consideration. References are being checked in preparation for interviews. Our intent is to complete the selection process soon after our May Board meeting. Once an Executive Officer has been selected, I plan to address other staffing issues so that we may be fully responsive to the interests of Congress in exercising our policy-making responsibilities.

The NSF Authorization Act expanded the Board's activities covered by the Government in the Sunshine Act. I know that the Committee has concerns in this area, and I am pleased to report that all Board committee, subcommittee, and task force meetings, as well as the full Board meetings, are now open to the public except for those very few portions that fall under the exceptions stated in the Sunshine Act. These procedures were in effect for our February and March meetings. While we continue to refine our processes, the new openness of our deliberations has been embraced by Board members and well received by the press and other members of the public.

The Foundation's fiscal year 2003 Appropriations Act provided a separate budget of \$3.5 million for Board operations and activities in this fiscal year, and the accompanying conference report requested budget justification materials in support of the National Science Board's fiscal year 2004 funding requirements. I want to take this opportunity to report our progress on these matters.

We are working through the many details related to allocating this first-time appropriation for fiscal year 2003. We have prepared operating plans that enable the Board to allocate its expenses for the current fiscal year against that appropriation.

On the matter of a fiscal year 2004 budget, the Board's first meeting since the appropriation bill was signed took place in early March, only a short time after the bill was signed. Therefore, there was limited opportunity for members to discuss the full range of options this legislation presents for fiscal year 2004. However, it is my intent to prepare budget justification materials for fiscal year 2004 as requested in the conference report. Our next meeting is scheduled for May, and I have scheduled time for a thorough and thoughtful discussion of those issues with the full Board. On behalf of the Board, I appreciate your understanding our interest in taking the time necessary to properly address these important questions. I will inform you of our plans as soon as possible following the meeting.

Consistent with our role as national policy adviser, the Board is nearing completion of two policy reports. Our Task Force on Science and Engineering Infrastructure has assessed the status, changing needs, and strategies to ensure that the Nation will have the science and engineering infrastructure to enable new discoveries in the future. The Board's final report with policy recommendations is being prepared for release on April 9. We made an extensive effort to seek public comment on the draft report, and we will conduct a broad-based outreach effort to engage a wide range of stakeholders in follow-up on those critical recommendations.

Another Board task force, the Task Force on National Workforce Policies for Science and Engineering, has been working diligently on U.S. science and engineering workforce needs and national policy options for ensuring a skilled workforce in the future. We anticipate that the draft report will be available for public comment in a couple of months. Your views would be especially valuable to us.

One final comment concerning Board policy reports: we want these documents to have the maximum possible impact on national science and engineering research and education issues. To that end, we are examining new and better ways to engage members of Congress, Administration officials, and the community in a continuing dialog on these critical topics. I will keep you fully informed as these efforts evolve.

Mr. Chairman, at this point I would like to end my formal remarks. I thank the Committee for its strong and sustained support of the science and engineering enterprise, especially the National Science Foundation. I thank you for the opportunity to testify on Federal budget issues and recent administrative changes as well as the Board's national policy activities. I would be pleased to answer any questions you may have or to provide additional information for the record. Thank you, Mr. Chairman.

Attachments: NSB-02-189 and NSB-02-191.

NSB-02-189

NOVEMBER 21, 2002

RESOLUTION

NATIONAL SCIENCE BOARD

*Guidelines for Setting Priority for Major Research Facilities*

The Committee on Strategy and Budget and the Committee on Programs and Plans recommend that the National Science Board approve revision to the Board's November 15, 2001 "Guidelines for Setting Priority for Major Research Facilities" in accordance with the following resolution:

RESOLVED, that the National Science Board approves the attached revision to NSB-01-204, entitled "Guidelines for Setting Priority for Major Research Facilities," and dated November 15, 2001, as recommended by the Committee on Strategy and Budget and the Committee on Programs and Plans.

MAXINE SAVITZ CHAIR,  
*Committee on Strategy and Budget.*

ANITA K. JONES CHAIR,  
*Committee on Programs and Plans.*

NSB-02-191

REVISED AND ADOPTED NOVEMBER 21, 2002

NATIONAL SCIENCE BOARD

*Guidelines for Setting Priority for Major Research Facilities*

The advancement of research and education in all fields of science and engineering depends—at some times—on equipment that permits observation and experimentation. Therefore, the National Science Foundation (NSF) funds such equipment. It also funds the research necessary to advance the engineering of next generation instruments that may enable entirely new and improved modalities of observation and experimentation.

Some of the equipment that enables the advancement of research is large, complex, and costly. The term facility is used to describe such equipment, because typically the equipment requires special sites or buildings to house it and a dedicated staff to effectively maintain and use the equipment. Multiple experimental researchers working in related disciplines share the use of such large facilities.

From time to time, a consensus arises within a research community that a particular new facility is required to advance the state of knowledge in the field. Such a consensus matures through broad community discussion. Through that discussion, a consortium sometimes arises from the community to take the responsibility to build and operate the facility for the good of the entire community. In all cases there are clearly stated research questions that only the unique, envisioned facility could help answer.

The National Science Board approves all large facility projects, as directed by the NSF Act of 1950 and based on the Board's revised delegation of authority to the Director (NSB-99-198, Appendix B, "Delegation of Authority," 335 NSB Meeting, November 18, 1999). When considering a facility project for approval, the Board reviews the need for such a facility, the research that will be enabled, readiness of plans for construction and operation, construction budget estimates, and operations budget estimates. Construction of many facilities is funded through the NSF Major Research Equipment and Facilities Construction account.

Due to cost, not all facilities can be built at the time that their need is determined and plans are in order for construction. Consequently, the Board will order facility construction projects with the intent that funding be made available to projects in this rank order. If it becomes necessary, the Board will reconsider both individual project approval and project priority.

The guidelines observed by the Board in approving and prioritizing such major facility projects and in approving the NSF budget submission are:

- Once construction for an approved and prioritized project commences, highest priority is given to moving that project forward through multiple years of construction in a cost-effective way, as determined by sound engineering and as long as progress is appropriate. It is most cost-effective to complete initiated projects in a timely way, rather than to commence new projects at the cost of stretching out in-progress construction.



- New candidate projects will be considered from the point of view of broadly serving the many disciplines supported by NSF.
- Multiple projects for a single discipline, or for closely related disciplines, will be ordered based on a judgment of the contribution that they will make toward the advancement of research in those related fields. Community judgment on this matter is considered.
- Projects will be authorized close to the time that funding requests are expected to be made.
- International and interagency commitments are considered in setting priorities among projects.

The above are guidelines. Each facility consideration involves many complex issues. The Board will consider all relevant matters, and could deviate from these guidelines, given sound reasons to do so.

Senator BOND. I do not mean to push you, but if you are going to be looking at the full recommendation some time in May, I certainly hope it is earlier May rather than later May, because we are going to be putting our bill together in May, and the sooner you can get it to us, the more likely we are to be able to take into account your views, so timeliness is key. We would very much appreciate having your views and your consideration at the earliest possible time.

Now we turn to Dr. Boesz, the Inspector General for the National Science Foundation. Welcome, Dr. Boesz.

#### STATEMENT OF CHRISTINE C. BOESZ

Dr. BOESZ. Chairman Bond, thank you. I appreciate the opportunity once again to appear before you. NSF's work over the past 53 years has had an extraordinary impact on scientific and engineering knowledge. However, as the nature of the scientific enterprise constantly changes, NSF is continuously faced with new challenges for maintaining its leadership position.

My office has and will continue to work closely with management to identify and address issues that are important to the success of the National Science Board and the NSF. Today, I would like to highlight four of the top management challenges facing the agency and tell you why I believe they are significant.

The first area is the management of large infrastructure projects. Over the past decade, NSF has increased its investments in such tools. Overseeing the construction and management of large facility projects and programs requires disciplined project management, while working hand-in-hand with scientists and engineers. As you indicated, my office has conducted two audits focusing on projects funded through NSF's major research, equipment, and facilities construction appropriation account. As of today, approximately half of our recommendations have been implemented. However, key recommendations essential for successful oversight and management remain unresolved.

First, a large component of NSF's corrective action plan is the development of a facilities management and oversight guide. While substantial effort has gone into this guide, it is still in draft form.

Secondly, NSF has recently completed a lengthy search for a new deputy for large facility projects, and as Dr. Colwell has indicated, the new deputy will assume his duties in June. We are hopeful that NSF will now be able to complete the guide and resolve other outstanding issues in this area. Another of NSF's continuing man-

agement challenges relates to the operation and management of the United States Antarctic program.

As you know, conditions in Antarctica are remote and harsh, so one of the challenges for NSF management is to ensure the safety and health of Antarctic personnel and researchers. Last month, my office issued a report on health and safety in Antarctic operations. We recommended that NSF address aging facilities and infrastructure. Specifically, we recommended that NSF initiate capital asset management planning and separate line-item budgeting processes.

Although NSF prefers the current practice of using research funds in a flexible manner, I believe a long-term, line-item approach would better identify resources necessary to assure continued safe operations.

The third area is award administration. NSF's challenge is in administering and monitoring its awards once they are made. For the past 2 years, NSF award management has led to a reportable condition in its financial statements audit report. Consequently, the auditors recommend that NSF implement a comprehensive risk-based post-award monitoring program. One of the biggest challenges that NSF faces in addressing this is the increased strain it places on resources, including human capital and support services.

Like many Federal agencies, NSF is facing human capital needs and challenges. Large numbers of permanent staff are eligible for retirement, and staffing has remained relatively flat, despite healthy budget increases. The continued reliance on a growing number of temporary staff places additional burdens on NSF, particularly its Office of Human Resource Management. NSF has contracted with a consultant to perform a comprehensive \$14.8 million business analysis of its operations. This does include a human capital component.

The first draft of the plan is due from the contractor in early 2004. The final plan at the end of 2005, so the fourth challenge focuses on human capital issues that demand urgent attention in the interim. NSF should develop a short-term plan that identifies its immediate human capital needs and the specific resources needed to support them such as training, space and equipment.

#### PREPARED STATEMENT

It is clear, however, that NSF needs resources to support its infrastructure as its budget expands and the workload increases.

Chairman Bond, this concludes my oral statement. I ask that my complete written statement be included for the record. I would be happy to answer any questions that you have. Thank you.

[The statement follows:]

#### PREPARED STATEMENT OF CHRISTINE C. BOESZ

Chairman Bond, Senator Mikulski, and distinguished members of the Subcommittee, I am Dr. Christine Boesz, Inspector General at the National Science Foundation (NSF). I appreciate the opportunity, once again, to appear before you today as you consider NSF's fiscal year 2004 budget request. NSF's work over the past 53 years has had an extraordinary impact on scientific and engineering knowledge, laying the groundwork for technological advances that have shaped our society and fostered the progress needed to secure the Nation's future. Throughout, NSF has maintained a high level of innovation and dedication to American leadership in the discovery and development of new technologies across the frontiers of science and engineering.

As the nature of the scientific enterprise is constantly changing, however, NSF is continuously faced with new challenges to maintaining its leadership position. My office has and will continue to work closely with NSF management to identify and address issues that are important to the success of the National Science Board and NSF. Each year, my office focuses on those issues that pose the greatest challenge for NSF management. These management challenges are developed based on our ongoing work with and knowledge of NSF's operations and programs. Today I would like to highlight four of these challenges and tell you why we believe they are significant.

#### MANAGEMENT OF LARGE INFRASTRUCTURE PROJECTS

For the past 3 years, we have considered management of large facility and infrastructure projects to be one of NSF's top management challenges.<sup>1</sup> Over the past decade, NSF has increased its investments in large infrastructure projects such as accelerators, telescopes, research vessels and aircraft, supercomputers, digital libraries, and earthquake simulators. Many of these projects are large in scale, require complex instrumentation, and involve partnerships with other Federal agencies, international science organizations, and foreign governments. Some, such as the new South Pole Station, present additional challenges because they are located in harsh and remote environments.

The management of these awards is inherently different from the bulk of awards that NSF makes. The majority of NSF awards are made to single investigators for individual research projects. In undertaking these "idea" projects, NSF researchers need to be given the freedom and autonomy to allow their research to evolve and move in new directions. In large facility and infrastructure projects, however, that same degree of freedom may sometimes be at odds with cost and schedule requirements. While overseeing the construction and management of these large facility projects and programs must always be sensitive to the scientific endeavor, it also requires a different management approach. It requires disciplined project management including close attention to meeting deadlines and budgets, and working hand-in-hand with scientists, engineers, project managers, and financial analysts. Furthermore, although NSF does not directly operate or manage these facilities, it is NSF that is ultimately responsible and accountable for their success. Consequently, it is vital that NSF exercise proper stewardship over the public funds invested in these large projects.

In December 2000, my office issued an audit of one of these large facilities, the Gemini Project, and made several recommendations to NSF management.<sup>2</sup> Primarily, our recommendations were aimed at increasing NSF's level of oversight of these projects with particular attention on updating and developing policies and procedures to assist NSF managers in project administration. In response to our report, NSF developed, and my office approved, a corrective action plan designed to address our recommendations. The final milestone in the corrective action plan, by which time NSF expected to fully address the report's recommendations and implement new policies and procedures, was December 2001.

Subsequent to issuing this audit report and at the request of this Subcommittee, my office conducted another audit focusing on all projects that NSF has funded through the recently renamed Major Research Equipment and Facilities Construction appropriation account.<sup>3</sup> We reported that certain practices discovered during our first audit have also occurred in other large projects, reinforcing the need for increased oversight by NSF management. NSF responded to our report by stating its intent to combine management improvements recommended by this audit with its efforts to respond to our previous Gemini audit.

As we will be reporting in our semiannual report to the Congress for the 6-month period ending March 31, 2003, NSF has taken steps to address approximately half of the report recommendations. However, key recommendations from both of these

<sup>1</sup>Memorandum from Christine C. Boesz, Inspector General, National Science Foundation, to Warren Washington, Chairman, National Science Board, and Rita R. Colwell, Director, National Science Foundation (Dec. 23, 2002) [hereinafter 2002 Management Challenges]; Memorandum from Christine C. Boesz, Inspector General, National Science Foundation, to Eamon M. Kelly, Chairman, National Science Board, and Rita R. Colwell, Director, National Science Foundation (Jan. 30, 2002) [hereinafter 2001 Management Challenges]; Letter from Christine C. Boesz, Inspector General, National Science Foundation, to Senator Fred Thompson, Chairman, Senate Committee on Governmental Affairs (Nov. 30, 2000) [hereinafter 2000 Management Challenges].

<sup>2</sup>Office of Inspector General, National Science Foundation, Audit of the Financial Management of the Gemini Project, Report No. 01-2001 (Dec. 15, 2000).

<sup>3</sup>Office of Inspector General, National Science Foundation, Audit of Funding for Major Research Equipment and Facilities, Report No. 02-2007 (May 1, 2002).

reports on developing new project and financial management policies and procedures remain unresolved by NSF management.

The unifying feature of NSF's corrective action plan was the development of a Facilities Management and Oversight Plan.<sup>4</sup> NSF staff has devoted substantial time and effort to develop this Plan. The Plan has four major goals: (1) to address organizational needs within NSF to effectively manage large facility projects; (2) to implement guidelines and procedures for all aspects of facilities planning, management, and oversight; (3) to improve the process for reviewing and approving large facility projects; and (4) to properly oversee facility projects to ensure their success. A large component of meeting these goals, especially the second and fourth, is the development of a Facilities Management and Oversight Guide, which is still in draft form.

We have been pleased to provide NSF with comments on various iterations of the Guide. Most recently, we reviewed and provided feedback on the November 8, 2002 draft. As we expressed to NSF, and will report in our upcoming semiannual report, our primary concerns with the Guide are (1) that its focus is too high level to provide NSF staff with the practical guidance necessary to effectively manage this complex portion of NSF's portfolio and (2) that it does not yet address recording and tracking the full cost of these facilities within NSF's financial system. Among the unresolved issues that we hope to see addressed in the final version of the Guide are the authority of the new Deputy for Large Facility Projects and his Project Advisory Teams, and the level of responsibility and autonomy of the individual program officers managing these projects. The Guide lays out general requirements that will need to be fleshed out in order to implement a successful management program. It also needs to address contingency issues, such as those arising with international partnerships, in more detail.

It has been over 2 years since our first audit report recommending improvements in NSF's management of large facility and infrastructure projects. Because of increased funding in this area, this issue needs to become one of greater urgency for NSF management. Some of this delay may have been due to the lengthy search for the new Deputy for Large Facility Projects. NSF announced last month that it has filled this position and the new Deputy will assume his duties on June 9, 2003. We are hopeful, with the new Deputy in place, NSF will be able to focus on the corrective actions and provide the resources necessary to fully implement the Facilities Management and Oversight Plan in order to resolve the outstanding issues in these two audits.

#### ANTARCTIC INFRASTRUCTURE PLANNING

Another of NSF's continuing management challenges relates to the operation and management of the United States Antarctic Program (USAP).<sup>5</sup> The USAP is the United States' national program for scientific research and geopolitical presence in Antarctica, the world's seventh and southernmost continent. Conditions in the Antarctic are remote and harsh. Temperatures at the USAP's three year-round research stations range from an average high of 2 degrees Centigrade at Palmer Station to an average low of minus 28 degrees Centigrade at South Pole Station. These conditions require much more support resources from NSF management than is required with other NSF-funded programs. As stated in NSF's fiscal year 2004 budget request, "[a]ll life support is provided by NSF, including facilities infrastructure, communications, utilities (water and power), logistics to, from, and within Antarctica and all related infrastructure—aircraft, runways, communications, passenger movement, baggage handling."<sup>6</sup> Consequently, one of the critical challenges for NSF management is to ensure the safety and health of USAP personnel and researchers.

Last month, my office issued a report on health and safety in the USAP.<sup>7</sup> We were pleased to report that the programs put in place and managed by NSF's USAP logistics contractor do protect the overall health and safety of the USAP participants. However, we did report on occupational health and safety issues related to aging facilities and infrastructure in Antarctica. They need to be addressed by NSF management through a capital asset management planning and budgeting process.

<sup>4</sup>National Science Foundation, Large Facility Projects Management & Oversight Plan NSB-01-153 (Sept. 2001).

<sup>5</sup>2002 Management Challenges, 2001 Management Challenges, and 2000 Management Challenges, *supra* note 1.

<sup>6</sup>National Science Foundation Fiscal Year 2004 Budget Request to Congress.

<sup>7</sup>Office of Inspector General, National Science Foundation, Audit of the Occupational Health & Safety and Medical Programs In the United States Antarctic Program, Report No. 03-2003 (Mar. 17, 2003).

This is an issue that has also been raised to NSF management by the Office of Polar Programs' Committee of Visitors.<sup>8</sup>

The Antarctic facilities are different from other large facilities funded by NSF in that they are critical to the safety and health of researchers and their support personnel. Ongoing maintenance and upgrading of these facilities are necessary to prevent health and safety crises and to protect the personnel stationed in this harsh environment. We are pleased to see that NSF, in its fiscal year 2004 budget request, is recognizing the need to plan for these crucial infrastructure needs. We are still concerned, however, over the funding of and planning for these projects. We have recommended that NSF develop life cycle planning of these USAP assets to serve as a basis for a capital asset management plan. In addition, to provide dedicated funding for these projects that does not compete with day-to-day USAP operations or scientific research, we recommended that NSF establish a separate line item within its budget for funding this plan. NSF prefers the current practice of using research funds in a flexible manner. I believe a long-term, line-item approach would more clearly identify resources necessary to assure continued safe operations.

#### AWARD ADMINISTRATION

A third ongoing management challenge to NSF is the administration of research and education grants and cooperative agreements.<sup>9</sup> In a given year, NSF spends roughly ninety percent of its appropriated funds on awards for research and education activities. NSF recently reported that it received more than 35,000 proposals in fiscal year 2002 and made more than 10,400 awards to about 1,800 institutions.<sup>10</sup> This was accomplished with a staffing level that has remained relatively flat during the past decade, even in the face of large budget increases.

NSF is under pressure to process increasing numbers of proposals and to make awards. Many of these proposals are also more complex. This increase is leading to a resource drain. Because NSF's proposal processing system is not yet entirely electronic, incoming proposals need to be printed for distribution during the proposal review process. During January and February alone of this year, NSF received over 14,000 proposals, representing forty percent of the normal 12-month total. The enormous volume of proposals has led to a backlog in printing. Resources to develop and implement a fully electronic system are needed to meet the increasing number and complexity of proposals.

An even more important challenge for NSF is the way in which it administers and monitors these awards. Administering the public funds that are entrusted to it is an inherent function of any government entity. Federal agencies are responsible for monitoring the awards that they fund to provide reasonable assurances that (1) adequate progress is being made toward achieving the project's goals, objectives, and targets; (2) Federal funds are being expended appropriately; and (3) Federal funds are being used responsibly. This is the essence of providing stewardship over Federal taxpayer dollars.

To date, NSF has not had a comprehensive and cohesive program for monitoring its awards once they have been funded. Rather, NSF has devoted most of its resources to the pre-award and award phases. In each of the past 2 years, this gap in NSF's award management has led to a reportable condition in the annual audits of NSF's financial statements.<sup>11</sup> The auditors have found that NSF's post-award monitoring system is not systematic, risk-based, documented in writing, or consistently applied. As a result, the auditors found that awardees' use of Federal funds may not be consistent with the objectives of the awards; programs and resources may not be protected from waste, fraud, and mismanagement; laws and regulations may not be followed; and reliable and timely information may not be obtained, maintained, reported, or used for decision-making. As a result of these findings, the auditors have recommended that NSF establish a comprehensive risk-based award monitoring program and develop the tools necessary to carry out this program.

NSF has recognized the need to create a risk-based award monitoring program and has begun to address this issue. The agency has developed a draft policy for conducting this level of award oversight, and we have been pleased to provide com-

<sup>8</sup>Committee of Visitors Report on the Polar Research Support Section for the review period 1998, 1999, and 2000.

<sup>9</sup>2002 Management Challenges, 2001 Management Challenges, 2000 Management Challenges, *supra* note 1.

<sup>10</sup>National Science Foundation, fiscal year 2002 Management and Performance Highlights 5 (Feb. 2003).

<sup>11</sup>Auditor's Report, fiscal year 2002 National Science Foundation Financial Statement Audit (Jan. 29, 2003); Auditor's Report, fiscal year 2001 National Science Foundation Financial Statement Audit (Jan. 18, 2002).

ments on that policy and anticipate that the final version will address our concerns. One of the biggest challenges that NSF will face in implementing this policy is the growing strain on its resources. The increased emphasis on award monitoring may require additional staffing and more resources for training, travel, and equipment. To meet all of its responsibilities, NSF management will have to show a greater commitment to this program. It may need to reevaluate its current business processes to ensure that its oversight responsibilities are fully integrated into them.

#### STRATEGIC MANAGEMENT OF HUMAN CAPITAL

As in the case of most Federal agencies, NSF is facing human capital needs and challenges. Forty percent of NSF's permanent workforce is currently eligible for either voluntary retirement or early out, and that number will grow to nearly sixty percent by 2007. Additionally, despite an increasing workload and a budget that has grown from \$1 billion to over \$5 billion over the past 20 years, the number of full-time equivalent positions at NSF has remained relatively static.<sup>12</sup> While NSF has been supplementing its permanent staff with temporary staff, or "rotators," this increase has also placed a significantly greater burden on the agency, particularly its office of Human Resource Management, to continually recruit and train personnel. Finding them suitable office space has also become a challenge—space has become a rare and precious commodity at NSF. Because of these concerns, I have identified strategic management of human capital as a top management challenge for NSF over the past few years.

Two years ago, this Subcommittee requested that my office analyze the adequacy of the agency's staffing and management plans in light of the efforts to expand NSF's budget of the next 5 years.<sup>13</sup> As I reported to you last year, NSF's workforce planning falls short of an actionable plan, which requires specific objectives, clearly assigned responsibilities, well-defined milestones for discrete actions, and practical measures of effectiveness for accountability. However, at that time, I also reported to you that NSF was in the process of contracting for a multi-year business analysis of its operations that will include a human capital management plan identifying its future workforce requirements.

Last June, NSF awarded a contract for a comprehensive, \$14.8 million, 3- to 4-year business analysis, including a component on future workforce requirements. The contractor appears to be focusing on the workforce portion of the business analysis during the early phases of the project. One of the contractor's teams has been conducting focus groups to develop core competencies at NSF and another team is gathering information on individual office staffing, workloads, and priorities. OIG management has met with both of these teams to discuss OIG core competencies and workloads.

The first draft of the human capital management plan is due from the contractor in early 2004. However, the final plan is not due until the end of 2005. We are looking forward to seeing substantial and concrete results from this effort, but wonder how NSF will manage its valuable human capital assets in the meantime. Along with being a principal component of the President's Management Agenda, this is a management challenge that NSF has been facing for several years. Consequently, human capital issues demand urgent attention. NSF needs to develop a short-term plan that identifies its immediate human capital needs and the specific resources required to support them (e.g., training, space, and equipment). It is clear that NSF needs resources to support its infrastructure as its budget expands and the workload increases.

Chairman Bond, this concludes my statement. I would be happy to answer any questions you or other members of the Subcommittee may have, or to elaborate on any of the issues that I have addressed today.

#### 2004 NSF BUDGET: INCREMENT OF INCREASE

Senator BOND. Thank you, Dr. Boesz, and thanks to all of you for very informative testimony. We will, of course, make all of the statements included in full in the record. My colleagues here are over on the floor, where I should be shortly, as I said, worrying about the supplemental appropriations bill. I can assure you that their absence from the hearing today does not reflect any lack of

<sup>12</sup> Compare NSF's fiscal year 1983 Budget Request to Congress with NSF's fiscal year 2004 Budget Request to Congress.

<sup>13</sup> S. Rep. No. 107-43 (2001).

interest or enthusiasm for the scientific work that is covered by your testimony today.

Let me begin by asking a question. I am going to ask first Dr. Marburger and then Drs. Colwell and Washington to comment on it. As we discussed yesterday, PCAST issued a report that recommended that beginning 2004, funding for physical sciences and engineering be substantially increased over the next four budget cycles. As co-chair of PCAST, you approved the recommendation the President sign the authorization bill authorizing a doubling of the budget in 5 years.

The fiscal year 2004 request only provides a 3.2 percent increase. What happened? Can you explain why the budget request is inconsistent with both PCAST and the NSF reauthorization act?

Dr. MARBURGER. Senator, probably the most important thing that happened was the absence of a passed 2003 budget at the time that the final budget was being put together.

Senator BOND. You did have the reports from both the House and the Senate which showed that we were going to increase substantially over the requested level for 2003.

Dr. MARBURGER. That is true, and I do believe the President put a lot of important signals in the budget narrative and in the priorities that are evident in the budget. His request for NSF was substantially greater than that for other science agencies and the evidence of his support for the doubling bill itself, for the authorization bill itself was, I think, significant, and bodes well for the future.

#### ADDITIONAL FUNDS INVESTMENTS

Senator BOND. I would ask you to comment on that, Dr. Colwell and Dr. Washington, and also we are going to find additional funds somewhere, somehow. Where would you recommend we spend them?

Dr. COLWELL. One of the major efforts that we have underway, of course, is increasing the grant size and duration, but first let me just say that the overall conclusion I do draw from the budget we got was that the President placed his full support and confidence in NSF's mission, but we did not have a budget to work from until recently.

In any case, one of the major initiatives for the National Science Foundation, and with the report that was requested, I believe, by OMB, we have found that the grant size and duration, which has gone from \$89,000 in 1998 to, through the good graces of this committee and Congress and the President, we have been able to increase it this year to \$128,000, but it is a long way to the \$250,000 that we would like to see for a per-year budget, and a 5-year budget for each grant, instead of just 2 years, which is inefficient. That is a very, very important investment for the National Science Foundation, and we either do this incrementally—of course, if we were to do it in one fell swoop it would be \$6 billion, so it is clear there are a lot of unmet needs, and we do appreciate the support that you and the committee have provided for the National Science Foundation.

Senator BOND. Dr. Washington.

Dr. WASHINGTON. Well, I was just going to add that the Foundation has the six priority areas, and we also have the need to increase funding in the core discipline areas.

When I talk with the program managers and the directors, they have many proposals that are excellently rated, and yet they do not have enough funds to actually, to sort of make those awards, and so there is a need for increased funding.

Senator BOND. Well, are there other particular program areas, like nanotechnology, plant genome, TechTalent, that you would see as meriting increases? Dr. Colwell.

Dr. COLWELL. Very clearly, the biggest crisis we face as a Nation, which was outlined in the Hart-Rudman report is that second, and I paraphrase, an attack on one of our cities, would be to lose leadership in science and engineering research and education, and it is very clear to me that the 21st century workforce is one of our major challenges, and we must address it, and again I would like to thank you for the increase in the stipends for graduate fellowships, because in this request we are requesting an additional 350 fellowships, and we know that these will go to American citizens, because that is the requirement that is there for the graduate fellowships, the IGERT and the GK-12.

And I must say that if I could I would like to share with you just some of the wonderful things that are happening in the investment in plant genomes, a novel method for determining gene function, which is called targeted induced local lesions in genes, or TILLIG, was developed through NSF funding, and what this does is, it allows selection for natural variance of rice genes with useful properties, and this is being set up, the TILLIG facilities for looking at these gene variations, at places including the International Rice Research Center in the Philippines.

Senator BOND. In the Philippines—where they have developed the golden rice, the beta carotene enriched rice.

Dr. COLWELL. Absolutely, so I think that is just one small example.

#### EXAMPLES OF ADDITIONAL FUNDS INVESTMENTS

Senator BOND. If you would send me a small packet of information on that I would like to find out more about it.

Dr. COLWELL. I would be delighted, sir.

[CLERK'S NOTE.—The information referred to has been retained in subcommittee files.]

Senator BOND. Thank you. Dr. Marburger, any thoughts you have on this?

Dr. MARBURGER. Yes. My office has formed interagency working groups under the National Science and Technology Council which tries to each year identify priorities that come up from the agencies and the advisory committees of the agencies, including the National Science Board, PCAST, and the National Research Council reports. We have identified for fiscal year 2004 six priorities, including the ones that I mentioned in my oral report and are outlined more completely in my written testimony, but certainly nanotechnology, networking and information technology, research on climate change, the need for technology associated with home-



land security, educational issues, and certain areas of biology that are not adequately funded under the NIH funds.

All of these areas are strongly represented in the NSF portfolio, and I know that NSF's priorities in science are quite consistent, not by accident, with the national priorities that have been identified for all areas, so I am confident that the increases in the NSF budget will be applied to the national priorities. We work closely together to make sure that that happens.

#### HUMAN AND SOCIAL DYNAMICS PRIORITY AREA

Senator BOND. Let me reflect upon a comment or recommendation made by the CBO, which suggested that when you look at the priorities, and certainly the priorities that you have outlined today are in hard physical science, math, engineering, but you are requesting increased funding in human and behavioral science. Well, that happens to be my area, but that does not happen to be what I thought the focus of the NSF was on.

With the tremendous short-changing we have of engineering and the hard physical sciences, where does human and behavioral science, which is also under a wide range of agencies that have interest and do research there, why does that continue to be a priority in the National Science Foundation?

Dr. Colwell.

Dr. COLWELL. Senator, it is very clear that the analysis of risk and understanding of risk and research on risk is very important, and it is funded through the social, behavioral, and economic sciences as part of the climate change initiative. Understanding risk is really critical.

Secondly, through the Computer Science Directorate, the human-computer interface is really very, very important to understand, and in the Education Directorate the use of technology in enhancing education is again critical, and that interface between understanding, as I pointed out in our Science of Learning Centers, understanding the cognitive aspects of learning, understanding the physiological basis of it and the reinforcement, this is all part of fundamental research that is very appropriate to the National Science Foundation.

#### NATIONAL SCIENCE BOARD BUDGET

Senator BOND. Let me move on with funding for the National Science Board, a question for Dr. Washington, then I might ask Dr. Marburger to comment on it.

The 2003 appropriations act and NSF reauthorization act provided the Board with tools to ensure fully effective statutory responsibility, execution, and providing independent science policy advice and overseeing the budget. The administration zeroed out the Board's budget despite what I thought was rather clear in the law. I understand the Board intends to comply with the law. Dr. Washington, does that mean that you expect OMB and the administration to submit a budget amendment?

Dr. WASHINGTON. I am still working that issue, but the feeling of the Board is that we would, of course, comply with the authorization act, so we will be preparing materials and presenting them to the Congress as requested.

Senator BOND. Dr. Marburger, can you help on that?

Dr. MARBURGER. The administration intends to comply with the law, sir.

Senator BOND. Well, I have got a suggestion. I trust you will take that back. Where the Congress has provided the Board, Dr. Washington, with the authority to hire its staff, I understand the Board is about to hire an executive officer. I hope the Board will also hire its own legal counsel so that the Board understands the laws that we pass, confusing as they may be, but I would like to get an update from you on where you are going with that authority and what you are doing with that.

Dr. WASHINGTON. Okay. Well, we are in the process of getting ready to interview on the final list in the search, and we expect to be carrying out the interviews somewhere at the time of the board meeting, and then it will be up to me to make the final selection for the new executive officer.

I have assembled an interview team made up of several board members, and hopefully we can come up with a final decision on that.

Now, in terms of legal counsel and all of that, I am going to talk to the Board about that at the May meeting, and working with the new executive officer, hopefully we can determine the sort of designated senior level staff members needed.

#### LARGE FACILITY MANAGEMENT ISSUES: PROGRESS

Senator BOND. Well, as a lawyer myself, I hate to be wishing more lawyers on people, but there are some issues, obviously, where it may be helpful.

Turning to Dr. Boesz, your testimony indicates that the Foundation's management has made little progress in responding to the large facility management problems identified. As we both have noted, the Foundation has just hired a deputy director. Do you believe that NSF can resolve these problems easily? Are they more complicated? Do you believe the NSF should have made more progress in addressing the management problems you identified, despite the delay in hiring a deputy director?

Dr. BOESZ. Mr. Chairman, there is a lot in that question. I believe that NSF has put a substantial effort into planning. From the perspective of my staff, this has been going on for about 2 years. Where we have become disappointed is, we were hopeful that the whole process would have been accelerated, because once all of these pieces are in place, the new deputy, the guidelines, they still require a tremendous amount of training both of NSF staff and the field.

So the fear has been on our part that this delay in getting all of these pieces in place will delay the training and delay the ultimate implementation, so I think the next challenge is going to be the training, assuming we are successful now.

Senator BOND. Two years does seem a bit long. Dr. Colwell.

Dr. COLWELL. Yes. I would like to state that we share the IG's sense of urgency in these issues, and we agree that NSF needs resources to support the infrastructure as our budget expands and the workload increases, but I want to tell you we are working very hard to live within our means and address the many opportunities

that we have to choose from in this very dynamic environment, and in a sense it is sort of like changing the tires when the car is moving at 60 miles an hour. It looks like things are in slow motion when you are in the car, but things are really moving very fast on the ground.

So over the past year we have accomplished a lot, as the NSF IG has recognized. There is more to be done, and we have an action plan in place, and many of our planning processes are iterative ones. We seek broad community input. We work to have consensus, expert opinions, and the result still may be a draft document, but we want to let the breezes in rather than carve things in stone. We developed living, breathing plans and guides that will evolve as the lessons are learned and as more best practices are identified. We want documents that work with us, not something written for the record and stuck on a shelf.

So I would like to say, is there more to be done? No question, but there is a lot of hard work being done at NSF by the people there, and you have my personal commitment that we will finish these activities and we will do it the right way, preserving the flexibility of the research enterprise, the integrity and stewardship of the taxpayer's dollars, and the excellent reputation of NSF, and your help would be appreciated. We need your support for the 2004 budget.

#### PLANT BIOTECHNOLOGY EDUCATION

Senator BOND. Let me assure you you have my support. If the car is going 60 miles an hour, pull off the interstate for a minute, hire the people you need. If you need more resources let us know, because we want to make sure that that 60-mile-an-hour car is going in the right direction. That worries me. If you are going 60 miles an hour and you do not know where you are headed that is not necessarily progress, so let us know if you need resources.

And finally, I want to try to conclude this by 11 o'clock, but I cannot get out of here without talking about plant biotechnology, and I know you would be disappointed if I did not. I just had to bring this in.

Dr. Marburger, yesterday you and I discussed, we are very interested in expanding plant biotechnology to the developing world countries in places like Africa. Unfortunately, Africa is being afflicted with and infected with the eurosclerosis, which has come from certain scientific know-nothings who think that plant biotechnology is going to create the tomato that eats Missouri.

I would like to know what plans the administration has for trying to educate and lead and assist other countries in learning about regulating and implementing the benefits of plant biotechnology.

Dr. MARBURGER. Plant biotechnology is an important area of research for us and for our agricultural industry and for other industries that may benefit from plant genomics and products that are made by plants. Our organization, OSTP, has an interagency working group that has just produced a report on plant genomics, a 5-year document that we have made available to your office, and we plan to encourage the agencies that are involved in that to take the necessary steps to implement the plan.

Members of my office do travel to international conferences to learn about attitudes in other countries regarding plant genomics. We encourage people from other scientific agencies as well to participate in forums and discussions and brainstorming sessions regarding this very difficult issue.

I meet twice annually with the Science Ministers from the other G-8 countries, and this issue of properly educating the public regarding the promise of plant genomics is always on the agenda. Someone always brings it up in those countries, and discusses how we can work together to identify and promulgate best practices.

It is an international problem. It is not only in Europe. There are pockets of concern not always rational about these issues, and we are watching this very closely and trying to develop strategies where we can.

Senator BOND. Yes, Dr. Colwell.

Dr. COLWELL. Senator, as you know, I am committed to expanding NSF's activities with the developing world. My own personal research on cholera has led to strong collaborations in Bangladesh and other countries in the third world. The National Science Board also produced an excellent report on international science and engineering, stressing the importance of developing collaborations with scientists in the developing world.

We have a series of workshops that we are supporting, and collaborative efforts throughout the developing world focusing in many cases on plant biotechnology, and we have collaborations on the banana and plantain research in Africa, Central and South America. We have PIs working on various cereals involved with the AID-sponsored activities to develop the cereal genome initiative that links researchers in the United States and developing countries.

Clearly, this is an important area, and I personally am very committed to it, as are the rest of the scientists at the National Science Foundation.

#### ENGINEERED VACCINATIONS

Senator BOND. Talking about cholera, would you tell us, I keep hearing that perhaps we can genetically engineer a banana or some other vegetable or fruit to contain a vaccine to vaccinate children throughout the emerging world against cholera and other diseases. Do you see this as a potential? Where is this? To me it sounds like science fiction, but I am hoping it can be a reality.

Dr. COLWELL. Senator, this is one of the most exciting developments, the ability to insert vaccine genes into a banana or a potato, and then children being able to be vaccinated without having a cold chain.

One of the problems with vaccine delivery is keeping it refrigerated and therefore potent, but if you have got the genes inserted and it is a benign immunological procedure that takes place by just eating the banana, this is a wonderful way for vaccination to work. Charlie Arntzen and his team are responsible for having achieved this. The field tests have been done, and it has proved effective, so yes, this is clearly one of the most exciting developments in plant genome sciences, and again, thank you for your support.

## NSF/USAID COLLABORATION

Senator BOND. This is truly exciting, and it is not only the cold chain, but for the small child that is going to get vaccinated, a banana is certainly a lot less threatening than a needle or a bunch of pinpricks.

Dr. Clutter, could you come up just for a second and tell us what you have been doing in your area in the collaboration with USAID and other areas on this work?

## STATEMENT OF MARY CLUTTER

Dr. CLUTTER. Well, Senator Bond, before I say anything about what we are doing with AID, I would like to express our appreciation to you for having taken the lead in the plant genomics field, because whether you realize it or not, your support and the committee's support of plant genomics has transformed plant biology forever. I just wanted you to know that.

Senator BOND. Thank you.

Dr. CLUTTER. We have begun some discussions with AID. In the past, we had a very successful program with AID in which we supported, NSF supported research in this country, and the training of developing country scientists, students in our universities, and when they went back home to their developing world countries, AID provided support for them and their research, so this kind of capacity building is very, very important, and we are looking to the future for more interactions.

Senator BOND. Thank you very much, Dr. Clutter.

Dr. Colwell, we appreciate that. We intend to support it.

Dr. Clutter, I sincerely appreciate your kind words, because when you and I and Dr. Colwell's predecessor were working on this, I do remember the scientific outcry that some politician would be messing around in the area of science, and I am going to frame some of those comments that were made at the time. I wear them as a badge of honor. Thank you very much.

## ADDITIONAL COMMITTEE QUESTIONS

As I said, I would love to spend the whole day here, but I think I have other duties calling. I know you have work to get on with. We have got a lot of kids that we need to get interested in science and engineering, and I wish you well. Carry on this work. This is the vital work for the future, and I thank all of you. We will submit questions for the record.

[The following questions were not asked at the hearing, but were submitted to the agencies for response subsequent to the hearing:]

## QUESTIONS SUBMITTED TO THE NATIONAL SCIENCE FOUNDATION

## QUESTIONS SUBMITTED BY SENATOR CHRISTOPHER S. BOND

## NSF FUNDING PRIORITIES

*Question.* I will try to provide additional funds for the Foundation in the fiscal year 2004 bill. Drs. Colwell and Washington, what priority areas do you recommend for additional funds?

*Answer.* Both NSF and the NSB are in agreement that increasing the average award size and duration are priorities of the Foundation. NSF grants to researchers currently average about \$128,000/year for 3 years, well below the optimum level of

\$250,000/year for 5 years as identified in the Principal Investigator (PI) survey conducted last year. PIs indicated that additional funds would most often be used to support more graduate students and post-docs in the research activity.

#### LEGAL COUNSEL FOR THE NATIONAL SCIENCE BOARD

*Question.* The Congress provided the National Science Board with the authority to hire its own staff. I am a big proponent of this measure because it helps ensure the independence of the Board and helps the Board meet its oversight responsibilities.

Dr. Boesz, do you have your own legal counsel?

Answer. Yes; in carrying out audits, investigations, and other activities that are the responsibility of the Office of Inspector General (OIG), I periodically need legal advice and assistance. It is important that the OIG have its own counsel, to minimize conflicts of interest for the attorney serving in this position and to preserve the operational independence of the OIG. The OIG counsel reports directly to me.

*Question.* Dr. Boesz, do you believe the Board should hire its own legal counsel?

Answer. Yes; for the same essential reasons that the OIG has its own counsel, separate from the National Science Foundation Office of General Counsel, I believe it is important that the Board have its own counsel. The reasons are to minimize conflict of interest for the attorney serving the Board and to support Board independence.

#### MAJOR RESEARCH EQUIPMENT AND FACILITIES CONSTRUCTION FOR FISCAL YEAR 2004

*Question.* Since the fiscal year 2004 budget request provides funds for the completion of HIAPER, which was already provided in the fiscal year 2003 Appropriations Act, would NSF support using these funds for other large facility projects? Which particular project(s) would NSF support?

Answer. Funding was provided for both HIAPER and IceCube in fiscal year 2003 appropriations, though no funds were requested. Therefore, NSF would first allocate fiscal year 2004 funds requested to all ongoing projects to make up for the rescinded amounts from fiscal year 2003, totaling \$15.81 million. With the same attention to maintaining the planned funding streams for projects, EarthScope would receive \$5.0 million, and Terascale \$10.0 million from remaining unallocated fiscal year 2004 funds. NSF would then use all the remaining funds (\$40.725 million) to support Scientific Ocean Drilling (SOD), the next project on the NSB-approved priority list as shown in the fiscal year 2004 budget request. This would allow us to initiate RSVP in fiscal year 2005, 1 year earlier than shown in the President's fiscal year 2004 budget request.

(Dollars in Millions)

	Fiscal year 2003 appropriation with re- scission	Fiscal year 2004 request	Adjusted fiscal year 2004 request	Fiscal year 2005 request	Fiscal year 2006 request	Fiscal year 2007 request	Fiscal year 2008 request
Project:							
ALMA .....	29.81	50.84	51.04	49.67	48.84	47.89	46.49
EarthScope .....	29.81	45.00	43.73	47.35	49.75	26.80	.....
HIAPER .....	25.36	25.53	0.17	.....	.....	.....	.....
IceCube .....	24.54	60.00	35.46	33.40	34.30	35.30	36.30
LHC .....	9.66	.....	0.06	.....	.....	.....	.....
NEES .....	13.47	8.00	8.09	.....	.....	.....	.....
NEON .....	0.00	12.00	12.00	16.00	20.00	20.00	20.00
SPSM .....	6.96	0.96	1.00	.....	.....	.....	.....
Polar Aircraft Upgrades .....	.....	.....	.....	.....	.....	.....	.....
Terascale .....	9.94	.....	10.06	.....	.....	.....	.....
Subtotal, Current MREFC .....	149.54	202.33	161.61	146.42	152.89	129.99	102.79
New Starts .....	.....	.....	40.73	.....	.....	.....	.....
Total, MREFC .....	149.54	202.33	202.33	146.42	152.89	129.99	102.79
New Starts:							
Scientific Ocean Drilling .....	.....	.....	40.73	36.12	23.00	.....	.....
RSVP .....	.....	.....	.....	30.00	42.66	44.00	20.25

(Dollars in Millions)

	Fiscal year 2003 appropriation with re- scission	Fiscal year 2004 request	Adjusted fiscal year 2004 request	Fiscal year 2005 request	Fiscal year 2006 request	Fiscal year 2007 request	Fiscal year 2008 request
Ocean Observatories .....	.....	.....	.....	.....	24.73	40.33	72.46
New Total, MREFC .....	.....	.....	202.33	212.54	243.28	214.32	195.50

## OPEN MEETINGS OF THE NATIONAL SCIENCE BOARD

*Question.* The NSF reauthorization bill included a requirement to ensure that the Board opened up its meetings.

Dr. Washington, can you describe what steps you have taken to comply with the law? You mentioned in your testimony that Board meetings are open for a few exceptions. Can you describe those exceptions?

Answer. The National Science Board publicizes its meeting schedule and meeting agenda, including discussion topics and agenda for the various committees on the Board website well in advance of all meetings. The Board is working to ensure that our plans and activities are open and transparent to all interested parties and publics. The few instances where sessions were briefly closed, Board members were involved in discussion and approval of budget items, personnel matters such as vacancies, selection of candidates for major awards and recognition, and other similar matters of a sensitive nature.

*Question.* Dr. Boesz, can you give us your assessment of the open meetings since you are required to audit the Board's compliance with this provision?

Answer. In my opinion, the Board has embraced openness in all of its meetings. The norm is now for open committee meetings and they have been reasonably well attended. This appears to have been a smooth transition with a minimal amount of disruption to Board activities. We look forward to submitting our first audit report next February and are pleased with the changes we have already seen taking place.

## MAJOR RESEARCH EQUIPMENT AND FACILITIES CONSTRUCTION PROGRAM

*Question.* The budget request contains a timeline and cost estimates for future construction projects through fiscal year 2008. Some of these future projects will receive a certain level of pre-development funding from the R&RA accounts even though its actual construction support will come from the Major Research Equipment and Facilities Construction account.

Dr. Colwell, I have two questions: (1) Aside from the projects mentioned in the requested budget, how many other projects are in the pipeline, and how much is NSF spending on pre-development for these projects? (2) Does NSF have a centralized system to track any new potential large facility projects that receive pre-development funds?

Answer. NSF often supports the early design and development of potential large facility projects. NSF has developed, and is in the process of implementing, a centralized system to track projects at all stages, including the early stages of design and development. While NSF may track such projects in their early stages, they are not identified and tracked as MREFC projects (or being in the pipeline) until they are approved by the National Science Board (NSB), which is usually after initial design and development is completed.

Currently, there are three projects approved by the NSB but not yet funded. These projects—Scientific Ocean Drilling, Rare Symmetry Violating Processes, and Ocean Observatories—are identified and discussed in the MREFC chapter of the Fiscal Year 2004 Request.

## BUSINESS ANALYSIS PLAN

*Question.* Last June, NSF entered into a 3-year, \$14.8 million contract with Booz-Allen-Hamilton to develop a business analysis plan for the agency's administration and management. Frankly, this is a large and expensive contract for an agency of the size of NSF. I am also concerned that your term, Dr. Colwell, is scheduled to end before the planned completion of the business analysis plan contract.

What assurances can you provide the Committee that this contract will be implemented as planned and will provide the anticipated deliverables geared to sup-

porting NSF's mission and making informed future investments in administration and management?

Answer. NSF has developed an Administration and Management (A&M) strategy as part of its overall strategic planning process that is consistent with the President's Management Agenda priorities and other external requirements. A key element of NSF's A&M strategy is a comprehensive, multi-year business analysis. The outcomes of this business analysis will guide long-term integrated administration and management investments that promise important mission-focused results. The business analysis responds directly to issues raised in the President's Management Agenda, to government-wide issues identified by the General Accounting Office (GAO) and others, and to agency-specific challenges such as the effective management of an increasingly multidisciplinary science and engineering research and education portfolio, and the management and oversight of an increasing number of complex large facility projects.

The business analysis involves the concurrent consideration of human capital and next-generation technology-enabled systems in an analysis framed around the Agency's core business processes:

- Resource Allocation;
- Merit Review;
- Award Management and Oversight;
- Knowledge Management; and
- Performance Assessment and Accountability.

The primary goals of the NSF Business Analysis effort are to:

- Document each of the agency's core business processes and define its contribution to the NSF mission;
- Define process effectiveness and efficiency improvements that capitalize on best practices;
- Develop future-looking business process scenarios and criteria for success;
- Design a human capital management plan to provide next-generation human capital capabilities; and
- Develop an integrated technologies and enterprise architecture plan for future systems in support of the agency's business processes.

NSF has also identified a series of indicators for success of the business analysis to help guide the project planning throughout the 3-year effort. Through the business analysis, NSF expects to achieve:

Business Processes that...

- Effectively address emerging trends in NSF's S&E portfolio;
- Leverage NSF core strengths and are consistent with NSF's mission and vision;
- Achieve NSF customer service goals; and
- Incorporate best practices from the public and private sectors.

A Human Capital Management Plan that...

- Enables the hiring/retention of the right mix of people;
- Addresses succession planning and Government-wide human capital requirements;
- Identifies effective learning strategies that develop critical competencies and skills;
- Manages projected workload and competency needs; and
- Provides flexible workforce classifications.

A Technology and Tools Plan that...

- Provides an integrated Enterprise Architecture (EA) platform that supports and enables NSF's evolving business processes;
- Defines a migration strategy to guide NSF's implementation of its new EA;
- Provides the infrastructure capability to meet future workflow demands; and
- Leverages technology to support forward-thinking business processes.

The business analysis is structured to ensure maximum participation and "buy-in" on the part of NSF management and staff and the external communities that NSF serves. Nearly 300 members of the NSF staff have already participated in the business analysis effort through interviews, focus groups, and process teams. In addition, over 2,000 NSF grant applicants responded to a survey developed as part of the business analysis to gauge community satisfaction with NSF's processes and services.

The business analysis is also designed to produce fully researched and justified recommendations that can be implemented by NSF. Rather than submit to NSF a list of static recommendations at the end of the review period, the contractor, working in partnership with NSF, will develop scenarios for process improvement throughout the course of the study. These scenarios will include a business case, pros and cons, an implementation plan, and criteria for successful implementation.



NSF is completely confident that the business analysis will produce a clear roadmap for significant improvements in NSF's business processes, human capital management, and technology and tools management; and will inform the agency's investments in Administration and Management for the foreseeable future.

#### MATH AND SCIENCE PARTNERSHIP (MSP) PROGRAM

*Question.* Can you give us an update on the progress of the new Math and Science Partnership program. To what extent are you coordinating your program with the Department of Education?

*Answer.* In fiscal year 2003, 271 proposals were received for the second solicitation (NSF 02-190) for MSP Comprehensive and Targeted Projects (84 Comprehensive projects and 187 Targeted projects). In February and March 2003, reviewers came to Arlington to provide their analyses of the proposals. These proposals are currently in the review process with awards expected by September 2003.

The initial MSP Program Solicitation for Comprehensive and Targeted Projects, NSF 02-061, was developed by NSF staff in cooperation with staff from the Department of Education (ED). In addition to the formulation of guidelines and review criteria that met the MSP and other goals of the Foundation, NSF and ED staff also worked to purposefully insert language into the program solicitation that would encourage the field to submit MSP proposals of interest to ED.

For the second MSP solicitation, NSF 02-190, ED provided the names of numerous potential reviewers, many of whom were invited and then joined on sub-panels that met in February and March 2003. As noted above, analysis of all the submissions and reviews are ongoing with awards expected by early Fall 2003.

NSF and ED Program Officers also work together on the Research, Evaluation and Technical Assistance (RETA) portfolio. Both NSF and ED senior managers and staff contributed to an inaugural meeting of RETA Principal Investigators and other project leaders in November 2002. For the full RETA solicitation, NSF 03-541, ED Program Officers were invited to participate in the development of the new solicitation and were invited to review the names of the reviewers that will meet to review MSP RETA proposals in June 2003.

In addition to collaboration on MSP at the staff level of the two agencies, further discussion and collaboration occurs at an interagency level through regular meetings co-chaired by Dr. Judith Ramaley (NSF) and Dr. Susan Sclafani (ED), thus bringing senior level insights and decision-making into the evolving MSP effort.

NSF and ED staff also worked together on an initial MSP Learning Network meeting, held in January 2003, that brought together Principal Investigators and other personnel from the initial cohort of Comprehensive, Targeted and RETA projects.

For fiscal year 2003, ED received an appropriation of roughly \$101 million to be reallocated to States for local Mathematics and Science Partnership efforts. NSF is collaborating with ED to arrange a workshop for staff from the Department of Education of each State and U.S. territory to learn about this new source of funding and to receive guidance on developing Requests for Proposals. The workshop is currently planned for June 13-14, 2003 in Washington, DC.

#### INTERGOVERNMENTAL PERSONNEL ACT APPOINTMENTS

*Question.* NSF's budget request includes a 21 percent increase in rotators through the Intergovernmental Personnel Act (IPA). These people come from other agencies to work at NSF for up to 4 years, but typically 2 to 3 years, and then return to their former agencies.

If there is a need for a larger workforce at NSF, why is NSF requesting to keep the number of FTEs for NSF staff at the current level? Why is NSF increasing its dependence on IPAs, which are temporary in nature?

*Answer.* NSF aims to employ a mix of permanent staff, IPAs, and Visiting Scientists, Engineers, and Educators throughout the Foundation. NSF's permanent staff provides the stable base of knowledge and expertise needed to operate efficient and productive programs within the Federal structure. IPAs and other temporary staff give NSF a direct, ongoing connection to the research and education community that complements the work of our external advisory committees and Committees of Visitors.

The plan for an increase of 30 IPAs in the fiscal year 2004 request should be viewed in context of the ongoing development and implementation of NSF's Administration & Management (A&M) Strategic Plan and the business analysis currently underway by Booz-Allen-Hamilton. NSF elected to request an increase in IPAs and defer requesting additional FTEs pending the outcome of the business analysis. We

expect the fiscal year 2005 request will be informed by the results of the business analysis.

THE SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS TALENT EXPANSION PROGRAM (STEP)

*Question.* An ongoing concern of Congress is the need for making sure that we have enough college students with majors in science, engineering, and technology fields. Congress has shown support for this program by making significant increases to the tech talent or "STEP" program in the last fiscal year. Why is NSF requesting only \$7 million for Tech Talent?

*Answer.* The NSF fiscal year 2004 budget was submitted to Congress before final action had been taken by Congress on the fiscal year 2003 request. The \$5 million (250 percent) increase requested by the Foundation for the STEP program in fiscal year 2004, from \$2 million to \$7 million, was approved by OMB many months earlier. The increase reflected our strong commitment to the importance of attracting more students to science and math and encouraging more students to major in science, technology, engineering and mathematics (STEM) fields. NSF agrees that our future as a Nation will be shaped in significant ways by the science and math competency of our citizens and by the quality and diversity of the science, technology, engineering and mathematics (STEM) workforce. Taken as a whole, NSF's commitment to workforce development is expressed in a cluster of related requests that together address key points of transition along the pathway to STEM careers. These include preparation for college and the transition to postsecondary study (MSP), the quality of the undergraduate experience (STEP), innovations in technological education (ATE) and support for advanced study (IGERT, GRF, GK-12). These investments are a package. They are supported and enhanced by the NSF request for the establishment of a new Workforce for the 21st Century priority area.

In addition, there are other components of the EHR portfolio that specifically address the preparation and professional development of science and math teachers and faculty. As a whole, the portfolio has a strong emphasis on workforce development.

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QUESTIONS SUBMITTED BY SENATOR LARRY CRAIG

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (EPSCoR)

*Question.* In fiscal year 2003, Congress appropriated \$90 million for the core EPSCoR program, but NSF requested only \$75 million in fiscal year 2004. This is below the fiscal year 2002 appropriation of \$80 million and would take EPSCoR back to the fiscal year 2001 level. I am disappointed to see that the National Science Foundation, while seeking an increase in funding in fiscal year 2004, has so reduced the EPSCoR program. Please justify the requested funding level.

*Answer.* Within the constraints of the overall EHR request, it was not possible to accommodate the priority increases such as the Math and Science Partnership while maintaining all programs in the existing portfolio at the Fiscal Year 2003 Current Plan levels. This required difficult decisions on where reductions could be taken while minimizing the adverse impact on program outcomes. In the case of EPSCoR, the requested fiscal year 2004 funding level of \$75 million will allow the program to meet its current obligations, including approximately \$41 million for existing Research Infrastructure Improvement awards. This level of funding will also allow continuation of EPSCoR's highly successful outreach program to acquaint EPSCoR researchers with NSF programs and policies and a comprehensive program of technical assistance designed to increase the success ratio of EPSCoR institutions in the NSF's major grant programs (e.g., Engineering Research Centers). Finally, the EPSCoR program also participates in co-funding efforts within the Foundation's regular grant programs, providing for an additional \$30 million for investigators in EPSCoR States to a total of \$105 million.

RESEARCH INFRASTRUCTURE IMPROVEMENT AWARDS

*Question.* I believe that the Research Infrastructure Improvement (RII) awards are the heart of the EPSCoR program. Without these awards, growth in science and research is virtually impossible in the participating States. States are now eligible for up to \$3 million per year for infrastructure awards. Please provide a status report on the awards made and the amount per State.

*Answer.* Over the past 3 years, the Research Infrastructure Improvement (RII) awards have provided support for infrastructure improvements in almost all EPSCoR States. To date, all States have had the opportunity to compete for these

awards of up to \$9 million for 36 months, although not all States have been successful in securing funding. The NSF staff works closely with unsuccessful States to provide a level of assistance that will help ensure increased competitiveness in the future. Shown below is a chart summarizing the RII funding to date.

RESEARCH INFRASTRUCTURE IMPROVEMENT GRANT PROGRAM (FISCAL YEAR 2001-FISCAL YEAR 2003)

[Dollars in millions]

State	Fiscal year 2001	Fiscal year 2002	Fiscal year 2003	Total
Alabama .....	3.0	3.0	2.5	8.5
Alaska .....	9.0	0.0	0.0	9.0
Arkansas <sup>1</sup> .....	0.0	0.0	0.0	0.0
Delaware <sup>2</sup> .....	0.0	0.0	0.0	0.0
Hawaii .....	0.0	0.0	3.0	3.0
Idaho .....	0.0	3.0	3.0	6.0
Kansas .....	0.0	0.0	3.0	3.0
Kentucky .....	0.0	3.0	3.0	6.0
Louisiana .....	3.0	3.0	3.0	9.0
Maine .....	0.0	0.0	2.0	2.0
Mississippi .....	0.0	2.0	2.0	4.0
Montana .....	3.0	3.0	3.0	9.0
Nebraska .....	3.0	3.0	3.0	9.0
Nevada .....	0.0	3.0	3.0	6.0
New Mexico .....	0.0	2.0	2.1	4.1
North Dakota .....	0.0	2.0	2.0	4.0
Oklahoma .....	0.0	3.0	3.0	6.0
Puerto Rico .....	0.0	0.0	2.1	2.1
South Carolina .....	0.0	3.0	0.0	3.0
South Dakota .....	3.0	0.0	3.0	6.0
Vermont .....	0.0	0.0	2.8	2.8
Virgin Islands <sup>2</sup> .....	0.0	0.0	0.0	0.0
West Virginia .....	0.0	3.0	3.0	6.0
Wyoming <sup>3</sup> .....	0.0	0.0	0.0	0.0
TOTAL: .....	.....	.....	.....	108.5

<sup>1</sup> Pending RII Proposal in fiscal year 2003.

<sup>2</sup> Denotes New EPSCoR Jurisdictions with planning grants.

<sup>3</sup> Submission in fiscal year 2003.

USE OF EPSCoR STATE FACULTY IN MERIT REVIEW PROCESS

*Question.* There has been considerable discussion about the need to increase the number of scientists and researchers from EPSCoR States on peer review panels and advisory committees. Please describe your progress and efforts to place more faculty from EPSCoR States on these panels and committees.

*Answer.* The National Science Foundation and the EPSCoR Office in particular have focused significant efforts in increasing the numbers of merit reviewers from the EPSCoR States. During the period 1996–1999, the EPSCoR Office monitored and reported the share of total NSF reviewers and panelists from EPSCoR States engaged in the Foundation's merit review process. The names of over 2,000 potential EPSCoR reviewers were also distributed among NSF's various Directorates. In addition, EPSCoR's outreach initiative has allowed NSF Program Officers to become more familiar with researchers and educators in EPSCoR States and encourage them to serve as merit reviewers and panelists for NSF grant competitions. The EPSCoR Office will analyze the reviewer data for fiscal year 2003 to determine if these activities have increased EPSCoR's share of total NSF reviewers and panelists engaged in the Foundation's merit review process from its previous level of approximately 7 percent (1996–99).

QUESTIONS SUBMITTED BY SENATOR PETE V. DOMENICI

RESEARCH INSTRUMENTATION AND INFRASTRUCTURE

*Question.* The National Science Board has released a draft report recommending that the Foundation substantially increase that portion of its budget that goes to help institutions acquire state-of-the-art instrumentation and research infrastruc-

ture. We know from past experience fields like astronomy are very dependent on infrastructure. The National Radio Astronomy Observatory (NRAO) operations in New Mexico and elsewhere are just one example.

Dr. Colwell, how does the Foundation intend to respond to the Board's report—particularly to the recommendation that calls for a program to address what is called “mid-sized infrastructure” (equipment in the millions to tens of millions of dollars)? How will such an effort be structured to benefit both the universities and national user facilities supported by the NSF?

Answer. Since the NSB report was released only 2 months ago, we are still examining its recommendations and how best to implement them. The Foundation's fiscal year 2004 budget request proposed increased funding for S&E infrastructure, including the MREFC Account and mid-size infrastructure projects, such as the Advanced Modular Incoherent Scatter Radar (AMISR). I have also encouraged Assistant Directors and Office Heads to continue to propose new mid-size infrastructure projects for funding in subsequent budget years.

In addition, NSF has continued to request increases in the Major Research Instrumentation Program (MRI). For this program \$90 million is requested in the fiscal year 2004 budget. In addition to support to research-intensive institutions for state-of-the-art research instrumentation, MRI provides substantial support to small schools, non-Ph.D.-granting institutions and minority serving institutions that are in need of cutting-edge instrumentation.

#### NATIONAL RADIO ASTRONOMY OBSERVATORY (NRAO)

*Question.* Dr. Colwell, in the fiscal year 2003 appropriations bill, we provided NRAO with a budget of about \$45.7 million. In the fiscal year 2004 request, NSF is proposing to fund NRAO at a level of \$42.7 million, which represents a reduction of about \$3 million. The request level of \$42.7 million would put NRAO below the fiscal year 2001 level. Given the new activities going on at NRAO—such as the construction of the new ALMA telescope and work to revitalize the VLA—what is the justification for such a budget cut?

Answer. The National Radio Astronomy Observatory (NRAO) remains one of NSF's most respected and productive national facilities. Our recent decision to proceed with construction of the international Atacama Large Millimeter Array (ALMA), in which NRAO leads the North American participation, exhibits our confidence in their management and the exceptional scientific merit of the program that they are carrying out across a wide range of radio astronomy.

The operating budget for NRAO in fiscal year 2001 was \$45.43 million, which included a \$5 million one-time increment for improvement of infrastructure, particularly at the Green Bank site. The fiscal year 2003 request level for NRAO was \$39.63 million. This request represented an approximate 2 percent decrease from the fiscal year 2002 level of \$40.43 million (which reflected the reduction of the \$5 million one-time increment) even though the request for the Division of Astronomical Sciences was down by 2.8 percent from the fiscal year 2002 level.

The fiscal year 2004 request level for NRAO is \$42.73 million, formulated before the fiscal year 2003 appropriation level was known. This is \$3.1 million above the fiscal year 2001 level (when the one-time increment is taken into account) and would support operations, maintenance, and instrumentation for the Robert C. Byrd Green Bank Telescope, the Very Large Array, and the Very Long Baseline Array as well as continued progress on the Expanded Very Large Array.

#### FORMULA-DRIVEN FUNDING INCREASES

*Question.* Dr. Colwell, you know that I am a major advocate for increasing research through the National Science Foundation and I am sure that Senator Bond and Senator Mikulski are going to do everything they can to support the Foundation even though the budget picture will be very constrained. Nevertheless, in recent days we have heard from those in the science community who are advocating something they call a “3–2–1” increase for NSF. For example, if the subcommittee could give NSF a \$600 million increase (an amount not too different than last year's increase), they contend that \$300 million would go to increase research; \$200 million should go for education and training (at the collegiate and K–12 level); and \$100 million be targeted for the Science Board's infrastructure recommendation. Do you think such a distribution makes sense and why?

Answer. A formula-driven increase in funding is unlikely to appropriately reflect either opportunities or needs in the research community. The distribution of a hypothetical increase in NSF's appropriation should reflect the priorities stated in the original budget request, which in fiscal year 2004 emphasized the need for investments in research tools and infrastructure. Other priorities include the need to in-

crease both the size and duration of awards, and the desirability of funding a greater proportion of existing quality proposals that go unfunded in every cycle. In that respect, additional funding for research activities could be used immediately to support proposals already reviewed, with a minimum of additional cost to the agency.

PROPOSED REDUCTION FOR THE SCIENCE, TECHNOLOGY, ENGINEERING, AND  
MATHEMATICS TALENT EXPANSION PROGRAM (STEP)

*Question.* Dr. Colwell, last year I joined with Senator Mikulski and Senator Bond—and others—to establish a program at NSF we call “tech talent”—a program designed to attract more U.S. citizens to pursue and acquire undergraduate degrees in science and engineering. Senator Mikulski, the chair of this subcommittee, provided \$22 million for that program last year. The fiscal year 2004 budget request provides \$7 million. Do you really want us to reduce the program by some 66 percent in 1 year when clearly the United States must do more to encourage our citizens to pursue degrees in these fields? What is the Administration’s rationale for this recommendation?

*Answer.* The NSF fiscal year 2004 request was submitted to Congress before the fiscal year 2003 budget was approved by Congress. The \$5 million (250 percent) increase requested by the Foundation for the STEP program in fiscal year 2004, from \$2 million to \$7 million, was approved by OMB many months earlier. This reflected our strong commitment to the importance of attracting more students to science and math and encouraging more students to major in science, technology, engineering and mathematics (STEM) fields. NSF agrees that our future as a Nation will be shaped in significant ways by the science and math competency of our citizens and by the quality and diversity of the science, technology, engineering and mathematics (STEM) workforce. Taken as a whole, NSF’s commitment to workforce development is expressed in a cluster of related requests that together address key points of transition along the pathway to STEM careers. These include preparation for college and the transition to postsecondary study (MSP), the quality of the undergraduate experience (STEP), innovations in technological education (ATE) and support for advanced study (IGERT, GRF, GK–12). These investments are a package. They are supported and enhanced by the NSF request for the establishment of a new Workforce for the 21st Century priority area.

In addition, there are other components of the EHR portfolio that specifically address the preparation and professional development of science and math teachers and faculty. As a whole, the portfolio has a strong emphasis on workforce development.

NATIONAL SCIENCE DIGITAL LIBRARY

*Question.* Dr. Colwell, NSF has been a leader in helping to close the so-called “digital divide” by its support for research and development related to digital libraries. However the fiscal year 2004 budget seeks to cut NSF’s support for the national science digital library (NSDL) from \$23 million to \$18 million—a \$5 million reduction in 1 year is substantial. Can you explain the rationale behind such a proposal?

*Answer.* The decrease in the request for the national science digital library was primarily due to the funding of the Core Integration project the previous year that allowed for centralized management of the library. Centralized management allows for operational efficiency and enabled a reduction in overall funding need for fiscal year 2004.

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QUESTION SUBMITTED BY SENATOR TIM JOHNSON

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (EPSCoR)

*Question.* Despite increases provided by Congress for NSF EPSCoR, the budget request for NSF EPSCoR has remained flat. The fiscal year 2004 budget request is \$75 million. This is the same level of funding as the level of funding appropriated for NSF EPSCoR in fiscal year 2001. Does NSF believe it would be beneficial to seeking greater levels of EPSCoR funding in the future?

*Answer.* Funding levels proposed for specific NSF programs each fiscal year are based on a number of factors including Administration priorities, and a desire to balance funding among competing priorities. The requested fiscal year 2004 funding level of \$75 million will allow the program to meet its current obligations, including approximately \$41 million for existing Research Infrastructure Improvement awards. This level of funding will also allow continuation of EPSCoR’s highly successful outreach program to acquaint EPSCoR researchers with NSF programs and policies and a comprehensive program of technical assistance designed to increase

the success ratio of EPSCoR institutions in the NSF's major grant programs (e.g., Engineering Research Centers). Finally, the EPSCoR program also participates in co-funding efforts within the Foundation's regular grant programs, providing for an additional \$30 million for investigators in EPSCoR States to a total of \$105 million.

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QUESTIONS SUBMITTED TO THE OFFICE OF SCIENCE AND TECHNOLOGY POLICY

QUESTIONS SUBMITTED BY SENATOR CHRISTOPHER S. BOND

PLANT BIOTECHNOLOGY RESEARCH IN THE DEVELOPING WORLD

*Question.* I am very interested in extending plant biotechnology to developing world countries in places such as Africa. I strongly believe that plant biotechnology can be a powerful tool in addressing the starvation that is occurring in Africa. However, like Europe, there are public misperceptions about the benefits of genetically modified crops.

To what extent is the Administration trying to educate other countries about plant biotechnology?

*Answer.* The State Department, USAID, USDA and other agencies have numerous activities designed to provide information to other countries on agricultural biotechnology. These include bilateral and multilateral (OECD, Codex, APEC, etc.) efforts to foster biotechnology research and the use of science-based regulatory systems. USAID has increased its spending in this area to \$25 million in both fiscal year 2002 and fiscal year 2003. The USDA is sponsoring a major ministerial conference that will be held this summer in California on new agricultural technologies (including biotechnology).

*Question.* The NSF Authorization Act expanded the plant genome program to develop partnerships between United States and developing world research institutions. What thoughts do you have in implementing this new authority?

*Answer.* One of the most effective ways to develop long-lasting partnerships in plant biotechnology between United States and developing world research institutions would be to form close working relationships directly between scientists. Scientists from developing countries can articulate their needs and U.S. scientists can tailor their participation based on those needs. Within the United States, this sort of activity would be best managed by an interagency collaboration between the NSF, USAID and USDA. Each agency brings to the table unique strengths that can be combined into a coherent program.

*Question.* To what extent have you discussed this matter with USAID? How can OSTP help us in coordinating these activities with other relevant agencies such as USDA?

*Answer.* The majority of OSTP's effort in agricultural biotechnology has focused on domestic regulatory issues, risk assessment research, and genomics. OSTP coordinates these activities through: the NSTC Interagency Working Group (IWG) on Plant Genomes, which has provided oversight and overall guidance to the National Plant Genome Initiative since 1998; the NSTC Subcommittee on Biotechnology; and the NEC Agricultural Biotechnology Working Group. Using these mechanisms, OSTP will work with the agencies to assist in the coordination of their international agricultural biotechnology activities. For example, the IWG on Plant Genomes is exploring ways to link developing country scientists to U.S.-funded plant genome research programs.

PRIORITY SETTING FOR MAJOR RESEARCH FACILITIES

*Question.* Due to the perceived subjectivity of NSF's priority-setting process for large research facilities, there has been an increased effort by various scientific interest groups to lobby the Congress on their specific project. This creates the perception that if you cannot get past the decisions of the Director, then going to Congress directly is an acceptable route. In response to this concern, we asked the National Academy of Sciences to develop criteria to rank and prioritize large research facilities.

Dr. Marburger, what are your views about this issue? Do you support the NAS study and do you think that a rational, objective, and fair system can be created to prioritize NSF's large facilities?

*Answer.* No longer the exclusive province of physics and astronomy, resource-intensive instrumentation has opened significant new opportunities for discovery and applications in every technical field. This has led to the emergence of demands for expensive facilities and instrumentation across a wider spectrum of fields than in the past. As a result, the fields traditionally associated with "Big Science" are expe-

riencing increased competition for funds. I regard the interest shown among the science community and within Congress in NSF's facilities programs to be a symptom of this growth in the need for complex, expensive instrumentation in the post cold-war era. The issues Congress has asked the National Academy of Sciences to address are not confined to the National Science Foundation and probably cannot be fully resolved in isolation from other agencies, or indeed from other nations. I am supportive of the process that the National Academy has undertaken and am looking forward to learning of their recommendations.

#### MATH AND SCIENCE PARTNERSHIPS

*Question.* Can you give us an update on the progress of the new Math and Science Partnerships program? To what extent are you coordinating your program with the Department of Education's math and science program?

*Answer.* The Math and Science Partnership (MSP) program is administered by the Education and Human Resources Directorate (EHR) of the National Science Foundation (NSF). The guidelines for proposals under the initial MSP Program Solicitation (NSF 02-061) for Comprehensive and Targeted Projects were released on January 30, 2002. In response to this Solicitation, 286 MSP proposals were submitted from the field in April 2002. These were reviewed in June 2002 by 23 subpanels. Reviewers were drawn from around the Nation and represented a diverse group of distinguished researchers, educators and practitioners from institutions of higher education, K-12 schools and school districts, not-for-profit and for-profit organizations, and other stakeholders representing the fields of mathematics, science, engineering, administration, evaluation, assessment, technology, and policy. Ultimately, 24 awards were made, 7 to Comprehensive projects (K-12, both mathematics and science) and 17 to Targeted projects (more focused in scope).

In fiscal year 2003, a second solicitation (NSF 02-190) for MSP Comprehensive and Targeted Projects called for full proposals to be submitted by January 7, 2003. In response, 271 proposals were received for 84 Comprehensive projects and 187 Targeted projects. In February and March 2003, reviewers came to Arlington to provide their analyses of the proposals. These proposals are currently in the review process with awards expected by September 2003.

In addition to the competition for MSP Comprehensive and Targeted Projects, the MSP program also makes awards for Research, Evaluation and Technical Assistance (RETA) projects to support the work of the partnership projects. A "Dear Colleague" Letter (NSF 02-103) calling for such RETA proposals was posted in March 2002, and 42 proposals were received in June 2002. Fifteen awards—many for design of potential larger scale efforts to be funded in the future—were made from the NSF fiscal year 2002 appropriation, and NSF program staff are currently managing these projects. A full solicitation (NSF 03-541) for RETA was posted in February 2003, with proposals due in May 2003 and to be reviewed in June 2003.

Regarding coordination of NSF efforts with those of the Department of Education (ED), OSTP has worked with staff from both agencies since the initial conceptualization of the MSP to make sure that they coordinate their efforts. The initial MSP Program Solicitation for Comprehensive and Targeted Projects was developed by NSF staff in cooperation with staff from ED. In addition to the formulation of guidelines and review criteria that met the MSP and other goals of the NSF, NSF and ED staff also worked to purposefully insert language into the Program Solicitation that would encourage the field to submit MSP proposals of interest to ED. The Solicitation included the following wording:

"As a subset of the targeted awards, the U.S. Department of Education and NSF will consider co-funding partnerships that address the following strategies:

- a) engaging classroom teachers in mathematical or scientific research and development projects sponsored by institutions of higher education and/or other private and public sector research organizations;
- b) engaging practicing teachers as professional colleagues who work together with scientists, mathematicians and engineers to master advanced new content and teaching strategies;
- c) demonstrating how technology can be used in the classroom to deepen the scientific and mathematical understanding of teachers and to promote higher student achievement; or
- d) establishing and evaluating the effectiveness of differential salary scales used to make the mathematics and science teaching profession more comparable in pay to the private sector, both as a tool to attract beginning teachers with deep mathematical or scientific training and as a means to create a career ladder capable of retaining highly skilled and effective teachers."

Following the release of the initial solicitation, NSF Program Officers met weekly to discuss the MSP review process and post-award management, and were joined by the lead ED MSP Program Officer who regularly participated in our cooperative work. An important component of that work was the identification of potential reviewers for the MSP proposals that were submitted. The ED Program Officer involved in MSP was also assigned as a Federal officer to two of the sub-panels of reviewers that met in June 2002.

Decisions about which proposals were most competitive for funding involved strong collaboration between NSF and ED. Twenty-two partnership projects were funded entirely through the NSF MSP appropriation. Two jointly funded projects continue to be cooperatively managed by program staff at both NSF and ED.

For the second MSP solicitation, NSF 02-190, ED provided the names of numerous potential reviewers, many of whom were invited and then joined on sub-panels that met in February and March 2003. As noted above, analysis of all the submissions and reviews are ongoing with awards expected by early Fall 2003.

NSF and ED Program Officers also work together on the RETA portfolio. In response to the initial "Dear Colleague" Letter, they (a) established the sub-panels that would review the proposals, and (b) guided the process of making decisions for awards. Both NSF and ED senior managers and staff contributed to an inaugural meeting of RETA Principal Investigators and other project leaders in November 2002. For the full RETA solicitation, ED Program Officers were invited to participate in the development of the new solicitation and were invited to review the names of the reviewers that will meet to review MSP RETA proposals in June 2003.

As you can see, both NSF and ED have continued to work in partnership on this program, culminating in a Math Summit hosted by Secretary Paige in February of this year. Dr. Colwell, Representative Ehlers and I spoke at the event, which launched the new Math and Science Initiative (MSI). The MSI is a broad based, interagency effort that includes not only ED and NSF, but also other science agencies such as NASA, NIH and the Department of Energy. More recently, representatives from private foundations, professional associations and textbook publishers have joined the Initiative. The goals of the MSI are to increase public awareness of the importance of math and science education, to improve the quality of teacher knowledge in these subjects, and to build the scientific knowledge base to guide improvements in teacher professional development and classroom practices. I continue to work with all of these agencies to ensure that Federal investments in improving the quality and effectiveness of K-12 math and science education are implemented in a manner that minimizes duplication and maximizes the difference these programs make for students and their teachers.

#### TECH TALENT

*Question.* An ongoing concern of Congress is the need for making sure that we have enough college students with majors in science, engineering, and technology fields. Congress has shown support for this program by making significant increases to the tech talent or "STEP" program in the last fiscal year.

Why is NSF requesting only \$7 million for Tech Talent?

Dr. Washington and Dr. Marburger, what are your views on the tech talent program? Do you believe there is a strong need for this program?

Answer. While the NSF reauthorization included the STEP program at levels of \$22 million in fiscal year 2003, \$30 million in fiscal year 2004, and \$35 million in fiscal year 2005, the NSF fiscal year 2004 budget was submitted to Congress before the fiscal year 2003 budget was approved by Congress. The increase requested for STEP in fiscal year 2004 reflects a strong commitment to the importance of attracting more students to science and math and encouraging more students to major in science, technology, engineering and mathematics (STEM) fields. I agree that our future as a Nation will be shaped in significant ways by the science and math competency of our citizens and by the quality and diversity of the STEM workforce. Taken as a whole, the Administration's commitment to workforce development is expressed in a cluster of related NSF requests that together address key points of transition along the pathway to STEM careers. These include preparation for college and the transition to postsecondary study (MSP), the quality of the undergraduate experience (STEP), innovations in technology education (ATE) and support for advanced study (IGERT, GRF, GK-12). These investments are a package. They are supported and enhanced by the NSF request for the establishment of a new workforce for the 21st century priority area whose goals are as follows:

- Prepare scientists, mathematicians, engineers, technologists and educators capable of meeting the challenges of the 21st century;
- Attract more U.S. students to science and engineering fields; and



—Broaden participation in science and engineering fields.

In addition, there are other components of the EHR portfolio that specifically address the preparation and professional development of science and math teachers and faculty. Taken as a whole, I believe that the portfolio has a strong emphasis on workforce development.

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QUESTION SUBMITTED BY SENATOR PETE V. DOMENICI

*Question.* Dr. Marburger—in January of this year the full Committee published in the Congressional Record a report to accompany what turned out to be the Senate's omnibus fiscal year 2003 appropriations bill. In that report, we called on OSTP to convene an interagency working group to look at the semiconductor design and manufacturing situation in this country relative to what was going on in other countries. Can you tell us where the Administration is on this matter? Is this Nation in danger of losing both its semiconductor design and manufacturing capabilities to other nations?

*Answer.* The Administration recognizes the importance of manufacturing to the Nation's economy and security, and is following the issue of manufacturing competitiveness through parallel activities. First, the President's Council of Advisors on Science and Technology (PCAST) is undertaking a study of high technology manufacturing. Because manufacturing plays a significant role in several important industry sectors, this study will not be limited exclusively to semiconductor manufacturing. It will, however, have a specific emphasis on the information technology manufacturing sector—including semiconductor manufacturing—and will be investigating issues of international leadership and offshore manufacturing trends, and their impact on technical capability and economic competitiveness. Mr. George Scalise, President of the Semiconductor Industry Association, will chair the PCAST sub-panel leading this study.

Second, Commerce Secretary Evans has asked his Undersecretary for Trade, Grant Aldonas, to work with others at the Department of Commerce and elsewhere in the government to undertake a comprehensive look at issues influencing the long-term competitiveness of U.S. manufacturing industries. This effort will include substantive outreach to the private sector. A report documenting the findings of this investigation and making recommendations for moving forward is expected later this year.

We expect that the studies that are now underway will provide a more definitive view into the issue of our Nation's semiconductor design and manufacturing capabilities and its ramifications and we will keep you informed as they progress.

SUBCOMMITTEE RECESS

Senator BOND. The hearing is recessed.

[Whereupon, at 11:05 a.m., Thursday, April 3, the subcommittee was recessed, to reconvene subject to the call of the Chair.]